B O S T O N   U N I V E R S I T Y

G R A D U A T E   S C H O O L

Dissertation

AN ANALYSIS

OF STANFORD-BINET TEST RESPONSES

IN THREE TYPES OF MENTAL DISORDER

by

Anna Louise Collins

(A.B. Boston University, 1892; A.M. Boston University, 1935)

submitted in partial fulfillment of the

requirements for the degree of

Doctor of Philosophy

1939.

556

APPROVED

by

First Reader . . . . Wayland F. Vaughan

Professor of Psychology

Second Reader . . . Samuel Sandalffens . . . . .

Professor of Psychiatry

ILLUSTRATIONS

Introduction.

Psychometric research has been concerned much in recent years with the problems of psychiatry, and this study is intended to be another contribution to the accumulating literature in the field. It resembles previous studies in that its general theme is the effect of psychosis on intelligence; it differs from them somewhat in the selection of case material, in the specific methods used in investigation, and, in some cases, in results obtained.

Specifically, the purpose is to analyze the test responses of nearly 700 patients in the Boston Psychopathic Hospital, and to interpret the evidence obtained with reference to the effect on intelligence of the particular psychosis involved. The subjects of the investigation are wholly unselected and no tests were given solely for the purpose of the study, but the data are assembled from the hospital files, and are the result of the routine testing of many years. The object is not to set up a definitely planned and directed experiment, but to see what information the regular routine and records of a diagnostic hospital can furnish as to the relation of psychosis and intelligence, in three widely different types of mental disorder. The procedure will be to arrange and examine statistically the scores of these subjects on the 1916 Stanford-Binet scale,   to interpret their responses through classification into different types of sub-test, and to determine if the variation in success and failure, the pattern of response, can furnish valid testimony as to the influence of different forms of mental disorder on various aspects of intelligence.

Terman's Measurement of Intelligence, the official handbook for

the Stanford-Binet revision of 1916, is the general source of information for all the details of the tests mentioned throughout the study, and is here indicated as the authority for all references to the Stanford scale.[1]

The writer desires to express here her deep sense of obligation and appreciation to the authorities of the Boston Psychopathic Hospital for the privileges accorded her in access to the files of the institution and the use of the records. More than all is she indebted to Dr. F. Lyman Wells and to Charles R. Atwell, of the psychological department, for far more than instruction in the psychometric methods that are the basis of the research; their constructive advice and unfailing encouragement are most gratefully acknowledged.

(1) Terman, Lewis M. The Measurement of Intelligence. Boston: Houghton Mifflin Company, 1916. Pp xvii + 362. (Riverside Text-Books in Education, edited by Ellwood P. Cubberley.)

The Field of Investigation.

Deterioration in intelligence as an effect of psychosis is the major problem for which evidence is sought. Studies in this field have been numerous, have dealt with many forms of psychosis, and have differed much in specific aims, in methods used, and in results obtained. On two basic principles, alone, has there been general agreement, that reduction of intelligence to sub-normal is not necessarily involved in all forms of psychosis, but that it is a common concomitant of those having an organic origin. For instance, Schott[1] concludes from his research that there is a normal distribution of intelligence among people with nervous and mental disorders, and that there is no causal relationship between intelligence and instability; Wells and Kelley[2] state that in organic cases alone does intelligence defect show definite association with the psychosis; many other writers concur. Psychometric methods have been used very largely in these deterioration studies, and have been directed both to the determination of general deterioration in intelligence, and to the differential effects of psychosis on specific mental functions. The tests used have been both standard intelligence tests, and, in a few cases, those devised or adapted by the investigator. The Stanford 1916 scale has been in such general use since its publication that it appears as the basis for a large proportion of the studies.

(1) Schott, E. L. "Superior Intelligence in Patients with Nervous and Mental Illness." Journal of Abnormal and Social Psychology, 1931, Vol. xxvi: 94-101.
(2) Wells, F. L. and Kelley, C. M. "Intelligence and Psychosis." American Journal of Insanity, 1920, Vol. lxxvii: 17-45.

A recent article by Malamud and Palmer[3] offers a convenient classification, dividing these deterioration studies into three groups: -

1. Quantitative: studies dealing largely with questions of scatter, i.e. irregularity in test performance. Research in this line has been carried on for the last twenty years, by various methods, with various interpretations of the scatter, and with conflicting and indeterminate results; these results have been well summarized recently by Harris and Shakow[4]. The scores forming the material of this Boston study will be examined for significance in this question of scatter.

2. Studies of special abilities and disabilities through responses to specific types of tests: here are classified the English studies in terms of the Spearman[5] bi-factor theory, and such American work as the memory researches of Achilles[6], Foster[7], Wells and Martin[8], and Hunt's[9] more recent comparison of schizophrenic and paretic reactions. Most of the work in this field has been done with the organic psychoses.

(3) Malamud, W. and Palmer, E. M. "Intellectual Deterioration in the Psychoses." Archives of Neurology and Psychiatry, Jan., 1938, Vol. xxxix: 68-81.

(4) Harris, A. J. and Shakow, D. "The Clinical Significance of Numerical Measures of Scatter in the Stanford-Binet." Psychological Bulletin, 1937, Vol. xxxiv, No. 3: 134-150.

(5) Hart, B. and Spearman, C. "Mental Tests of Dementia." Journal of Abnormal Psychology, 1914, Vol. ix: 217-254.

(6) Achilles, E. M. "Experimental Studies in Recall and Recognition." Archives of Psychology, 1920, Vol. vi, No. 44: pp 82.

(7) Foster, J. C. "Significant Responses in Certain Mental Tests." Journal of Applied Psychology, 1920, Vol. iv: 142-154.

(8) Wells, F. L. and Martin, H. A. A. "A Method of Memory Examination Suitable for Psychiatric Cases." American Journal of Psychiatry, 1923, Vol. iii: 243-257.

(9) Hunt, J. McV. "Psychological Loss in Paretics and Schizophrenics." American Journal of Psychology, 1935, Vol. xlvii: 458-463.

The scores used in this study will be classified as they seem to represent such functions as memory, judgment, reasoning power, speed of reaction, orientation; significant differences as shown in the scores will be noted.

3. The attempts to construct special measures for deterioration: the leaders in this research are Babcock[10] in this country and Simmins[11] in England. These agree in assuming the vocabulary ability as usually representative of the subject's pre-psychotic level of intelligence (Simmins[11] excepts some psychoses); they differ in using different types of test in estimating present efficiency. Schwarz[12] and Wittman[13] have used similar techniques with results similar to Babcock's.

Altman and Shakow[14] have used a similar method at the Worcester Hospital research department; they have compared groups matched for mental age, of schizophrenic, normal, and delinquent adults. Their "discrepancy score" differs somewhat from Babcock's "efficiency index", and they doubt the validity of an interpretation in terms of deterioration. Both discrepancy score and efficiency index are terms used by the authors named to designate the statistical statement of the results obtained by comparing vocabulary scores and mental age.

(10) Babcock, Harriet. "An Experiment in the Measurement of Mental Deterioration." Archives of Psychology, 1930, Vol. cxvii, No. 117: pp 105.
(11) Simmins, Constance. "Mental Incapacity." Character and Personality, 1935, Vol. iv, No. 1: 25-33.
(12) Schwarz, R. "Measurement of Mental Deterioration in Dementia Praecox." American Journal of Psychiatry, 1932-3, Vol. xii: 555-562.
(13) Wittman, P. "The Babcock Deterioration Test in State Hospital Practice." Journal of Abnormal and Social Psychology, 1933-4, Vol. xxviii: 70-84.
(14) Altman, C. and Shakow, D. "A Comparison of the Performance of Matched Groups of Schizophrenic Patients, Normal Subjects, and Delinquent Subjects on Some Aspects of the Stanford-Binet." Journal of Educational Psychology, 1937, Vol. xxviii: 519-529.

The relation of verbal and mental age scores in the Boston Psychopathic tabulation will be examined from the point of view of these studies.

A fourth method, that of retests and serial testing, has been used in many hospital studies, including some of these already cited, both as the chief method of the research and as a supplementary check-up of data obtained in other ways. The results have been conflicting and the method has been of more value in studying the mental effects of therapy than in measuring deterioration.

Some of the writers cited here have referred to a correlation as existent or non-existent, between the duration of the disease and deterioration. In some cases the term is apparently used to refer to clinical observation, in others statistical computation is made. Altman and Shakow[15] report a very low correlation, less than .10 between their discrepancy scores and the period of hospitalization. Wentworth[16] finds no correlation between duration and deterioration, but gives no details. In only one of the Boston Psychopathic groups, the epileptic, were there sufficient data on time of onset, for a similar comparison to be possible.

(15) Altman and Shakow, op. cit. pp 528.
(16) Wentworth, M. M. "Two Hundred Cases of Dementia Praecox, Tested by the Stanford Revision." Journal of Abnormal Psychology, 1923, Vol. xviii: 378-388.

Case Material.

For analysis, cases have been chosen of three types of mental disorder that differ widely in their symptoms, and, so far as present day knowledge has progressed, in their etiology. These are: -

General Paresis: organic in origin, as proved beyond all doubt by the work of many scientists, notably Krafft-Ebbing, Widal and Noguchi[1].

Schizophrenia: of functional origin as usually classified by psychiatrists[2], and even by those most prone to posit organic causes, admittedly assigned to a doubtful and possibly functional class[3].

Epilepsy: of doubtful origin, and the subject of many conflicting opinions; both as to cause[4], whether organic, traumatic, temperamental, hereditary, or environmental; and as to personality[5], whether innate and the cause of the disorder, or acquired and an effect.

The files of the Boston Psychopathic Hospital were open to the writer for the purposes of the study. The scores used are those of the hospital routine, given by many members of the psychological staff, through the years of the extensive use of the 1916 Stanford revision[6]. The administration of the tests and the scoring was according to the standardized

(1) Henderson, D. K. and Gillespie, R. S. A Text-book of Psychiatry. Oxford University Press. 1936. 4th edition. pp 301-2.
(2) Henry, George W. Essentials of Psychiatry. Baltimore, Williams and Wilkins Company, 1931. 2nd edition. pp 38.
(3) Moss, F. A. and Hunt, T. Foundations of Abnormal Psychology. New York. Prentice & Hall. pp xii + 548.
(4) Lennox, W. S. and Cobb, S. "Epilepsy." Medicine, 1928, Vol. vii: 105-290.
(5) Clark, L. Pierce. "A Psychological Interpretation of Essential Epilepsy." Brain, 1920, Vol. lxiii: pp 38ff.
(6) Terman, L. M. Measurement of Intelligence. Boston: Houghton Mifflin Company, 1916, Pp xvii + 362.

procedure; the subjects were unselected, and the cases are presumably a reliable sampling of the hospital's inmates. The scores are used in a study that is not clinical in any respect, but a statistical examination of patients' responses.

Under the direction of Merrill Moore, M.D., appointed head of a government project for the study of syphilis, a tabulation had been made by clerical workers, of the test scores of the patients in the hospital's neuro-syphilitic clinic; under the same direction there had been made a similar tabulation of the scores of epileptic patients. These lists were available to the writer and are the basis for the study of the test results in these two forms of mental disorder.

In the paresis tables, all of the cases were listed at first, but as the study progressed, it seemed wiser to confine the analysis to adults; the younger cases were presumably all due to juvenile paresis, and, being congenital, were in a different category from those of acquired paresis. The cases for analysis should be those in which the disease was acquired after full intellectual development was achieved. The limit was placed at twenty years, with the sanction of recognized workers in the field; e.g. Strecker and Ebaugh[7] find no case under twenty that is not juvenile paresis, and consider that symptoms of juvenile paresis always manifest themselves before that age. The cases are taken as listed by the hospital workers, and are nearly all of dementia paralytica diagnosis; a few cases of cerebral syphilis and tabo-paresis, which had been included

(7) Strecker, E. and Ebaugh, F. G. Practical Clinical Psychiatry for Students and Practitioners. Philadelphia. Blakiston & Son's Co., pp 64.

in the tabulation, are used with the general paresis cases in the study, as being all of similar origin; differential diagnosis of the syphilitic psychoses is sometimes of acknowledged difficulty even to the most expert[8].

All of the epileptic scores in the hospital tabulation are used. No attempt had been made at differentiation of types, but it is fair to assume that "idiopathic (essential) epilepsy" furnished by far the largest proportion of the cases, as in general practice. Some of these patients go on to institutional life; some are of the ambulatory variety attending the out-patient department. They are probably more representative than the distinctly institutional types like those of the Craig Colony studies[9].

The schizophrenic data were taken directly from the hospital files by the writer. File numbers of all dementia praecox cases of the last five years were furnished by research workers engaged in a project concerned with schizophrenia; these numbers were checked with the psychological department files, to find the patients who had been given Stanford tests, and the scores of these were copied from the records. As the 1916 Stanford has not been much used at the hospital since the publication of the new Stanford revision, not enough records were found in these five years for an adequate comparison with the paretic and epileptic lists. So the general files were consulted alphabetically for further test records until over one hundred more were obtained. These had been taken through the years from 1920 to 1933, and have been added to the first list. The complete list,

(8) Henderson and Gillespie, op. cit. p. 326.
(9) Doolittle, G. J. "The Epileptic Personality." Psychiatric Quarterly, 1932, Vol. vi: 89-96.

two hundred and ten in all, is believed to furnish a fair sampling of schizophrenic responses.

Classification into the four schizophrenic types was found to be impracticable for several reasons; the type was not always given in the earlier records, differential diagnosis was not always agreed upon, or the case was found to be of a mixed type. It was evident, however, that our cases were largely of the paranoid type; there are some recognized catatonic and hebephrenic subjects, a very few simplex, and some of a mixed or unspecified classification. It seemed wiser to make the criterion of selection, any case definitely diagnosed as schizophrenia, in which the complete Stanford formed part of the record. The short Stanford records which occasionally were found, are not used, because, despite the usual high correlation with the complete test in general rating, they do not give data for all the sub-tests desired.

Appended to the test reports, was usually a statement of the tester as to the representative character of the test results. These statements often expressed the view that the responses did not show the innate intelligence of the subject. This is, of course, a recognized fact, often noted in psychometric work with psychotics; their responses are influenced by the emotional state, the attitude, the past and present surroundings, as well as by the intelligence - as contrasted with the school child who accepts tests as part of the school work, with no feeling involved, and who usually gives a fairly valid picture of his mental capacity. In this study, however, the object is not to estimate innate but present intelligence; and perhaps it is a fair statement that the test results do give

evidence worth considering, of the state of the mentality at the time of testing, not of the individual's possible capacity, but of the effect of the disease on his intellect, i.e., a fair picture of the disorder, if not of the patient.

Chronological Age.

The chronological age distribution of the patients is shown in Table 1. The medians of the three groups are: paretic, 40 yrs., 10 months; epileptic, 24 yrs., 1 month; schizophrenic, 29 yrs., 5 months. Epilepsy, so often manifesting itself in childhood, shows the lowest median; schizophrenia, usually a disease of youthful but not child subjects, shows the next lowest figure. If the comparison is made with adult cases only, the epileptic median is 27 yrs., 2 months, differing very little from that of the dementia praecox cases. As the symptoms of general paresis commonly do not appear until many years after syphilitic infection, the median of the paretic group is much higher, as would be expected.

For additional illustration of the relative age incidence of the three disorders, the percentage of the adult cases at each ten-year interval is added to Table 1.

Table 1.

Chronological Age Distribution

Age	Paretic	Epileptic	Schizophrenic
5-9		12	
10-14		22	
15-19		14	24
20-24	9	43	45
25-29	18	38	41
30-34	32	26	41
35-39	59	20	24
40-44	40	10	9
45-49	38	8	12
50-54	33	3	7
55-59	15	2	5
60-64	5	1	1
65-69			1
	$\overline{249}$	$\overline{229}$	$\overline{210}$

Percentage of adult cases in each ten-year interval.

Age	Paretic percent of 249	Epileptic percent of 187	Schizophrenic percent of 210
16-19		19%	11%
20-29	11%	43%	41%
30-39	37%	24%	31%
40-49	31%	11%	10%
50-59	19%	2.5%	6%
60-69	2%	.5%	1%
	$\overline{100\%}$	$\overline{100\%}$	$\overline{100\%}$

Intelligence Quotients.

Mental age and intelligence quotient ratings of all the cases
were supplied by the tabulations described; these are not the main concern
of this study but are given as incidental to the analytic procedures. As
has been stated, it is now generally recognized that the Stanford-Binet
scale, standardized for children and youthful adults of school age, often
fails to furnish valid information concerning the mentality of mature
adults. It is also recognized that the I.Q., a more or less rough measure,
subject to the influence of experience and environment, is, per se, of
doubtful significance in studying the course of a psychosis in the individ-
ual; it may be of more value as showing group trends. So, too,the mental
age rating may not be of symptomatic significance in itself, but may be of
real value as supplying the norm in relation to which the evidence of spe-
cific abilities or disabilities in each subject is to be compared.

The distribution of the intelligence quotients, as computed in
the test records, shows a fairly normal distribution in all three groups,
with a wide range, 22 to 115 for the paretics, 25 to 117 for the epileptics,
and 40 to 116 for the schizophrenics. The tests furnishing these scores
were always given within a very few days of admission to the hospital; the
score of only the first test is used in the case of those who had made more
than one hospital visit, and taken more than one test. These scores are
believed to supply adequate evidence of the mental capacity of the patient
at the time of hospital entrance, without reference to the prognostic value
of the I.Q. or its validity with respect to innate intelligence.

Percentile values were computed and ogive curves drawn. (Figure 1)

For this type of curve, the ordinate of each point shows the percentage of the whole number of cases that were below the I.Q. at the point's abscissa.   The median of the paretic group falls at 70.50, of the epileptic at 69.50, and of the schizophrenic at 77.81.   On the assumption that each group furnishes an adequate sampling of each of the three disorders as represented in the hospital population, computation was further made to test the significance of these suggested differences.   This was done by the diff./ σ diff. formula; it was found that the difference between the paretic and epileptic groups was not reliable, but that there is a reliable difference between each of these and the schizophrenic.   The figures are:

Paretic and epileptic,   diff./ σ diff. = .5
Paretic and schizophrenic,   diff./ σ diff. = 3.6
Epileptic and schizophrenic, diff./ σ diff. = 4

(according to Garrett[1] the figure that is indicative of significance is 3)

Another comparison that seemed of interest to make was of the I.Q.'s of each group with those of the hospital patients in general.   There was available for this purpose a tabulation of the records of a large sampling of 1843 patients, made by C. R. Atwell, of the hospital's psychological department; this included the scores of all adult patients in the hospital who were given the 1916 Stanford during a period of about two years. This ogive curve is also included in Figure 1.   Of this distribution, the median is 78.67 and the average, 78.33, showing no significant difference from the schizophrenic, but a large quotient of reliability in the differences from the other two groups.   These figures are:

(1) Garrett, H. H. Statistics in Psychology and Education. New York, Longmain, Green & Company, 1938. 2nd edition. p 213.

Figure 1.

Boston Psychopathic Hospital

Ogive (Curves of I.Q.'s (16 year basis)

1843 Adult Patients (general)

229 Epileptic Patients

249 General Paretic Patients

210 Schizophrenic Patients

Percentiles

I.Q.
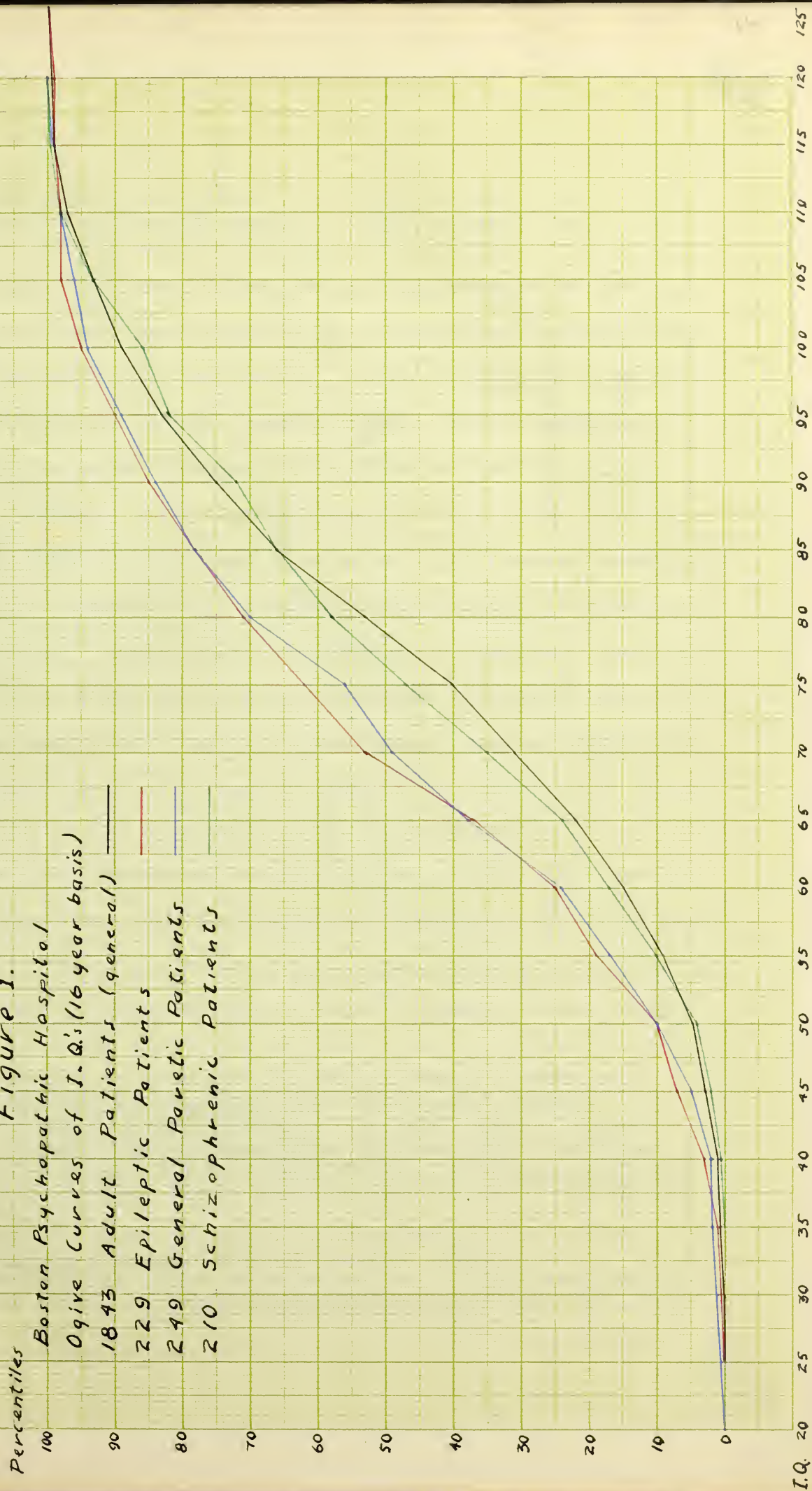
General hospital and paretics   diff./ σ diff. = 5.2
General hospital and epileptics   diff./ σ diff. = 5.7
General hospital and schizophrenics   diff./ σ diff. = .44

Comparison of the I.Q. results with those obtained by other investigators or through other tests, may be of interest as furnishing added evidence of the validity of the sampling. This was obtainable in two of the other epileptic studies that have been consulted, and in a tabulation of Yerkes-Bridges scores of 143 epileptic cases that was furnished by the Psychopathic Hospital. Figure 2 gives the ogive curves of the I.Q.'s of Fetterman and Barnes'[2] 104 Cleveland subjects; of Sullivan and Gahagan's[3] 103 Los Angeles children, and of a Boston listing of 143 I.Q.'s computed by the Yerkes-Bridges[4] point scale. The Cleveland and the Boston point scale curves, it will be noted, run very close to the Boston Stanford curve. The Sullivan and Gahagan curve, though of similar shape, runs decidedly higher, but their subjects were all 12 years or under in age, and therefore were not affected by the ceiling of the scale as are adult subjects.

As to the implications of these figures, it would seem, in the paretic, to add to the already accumulated statistical and clinical evidence often cited, of the greater effect of the organic psychoses on the intellect. Wells and Kelley[5] testify to this: Curtis[6], writing from the Boston

(2) Fetterman, J. and Barnes, M. "Serial Studies of Epilepsy." Archives of Neurology and Psychiatry, 1930, Vol. xxxii; 798-867.
(3) Sullivan, E. B. and Gahagan, L. "On Intelligence of Epileptic Children." Genetic Psychology Monographs, 1935, Vol. xvii: 309-376.
(4) Yerkes, R. M.-Bridges, J. W.-Hardwick, R. S. A Point Scale for Measuring Mental Ability. Warwick and York, Inc. Baltimore. 2nd edition. pp 219.
(5) Wells, F. L. and Kelley, C. M. Intelligence and Psychosis. American Journal of Insanity, 1920, Vol. lxxvii: 17-45.
(6) Curtis, J. N. "Point Scale Examinations on the High-Grade Feeble-Minded and the Insane." Journal of Abnormal Psychology, 1918, Vol.xiii: 77-118.

Figure 2

Epileptic Cases - Ogive Curves of I.Q.'s
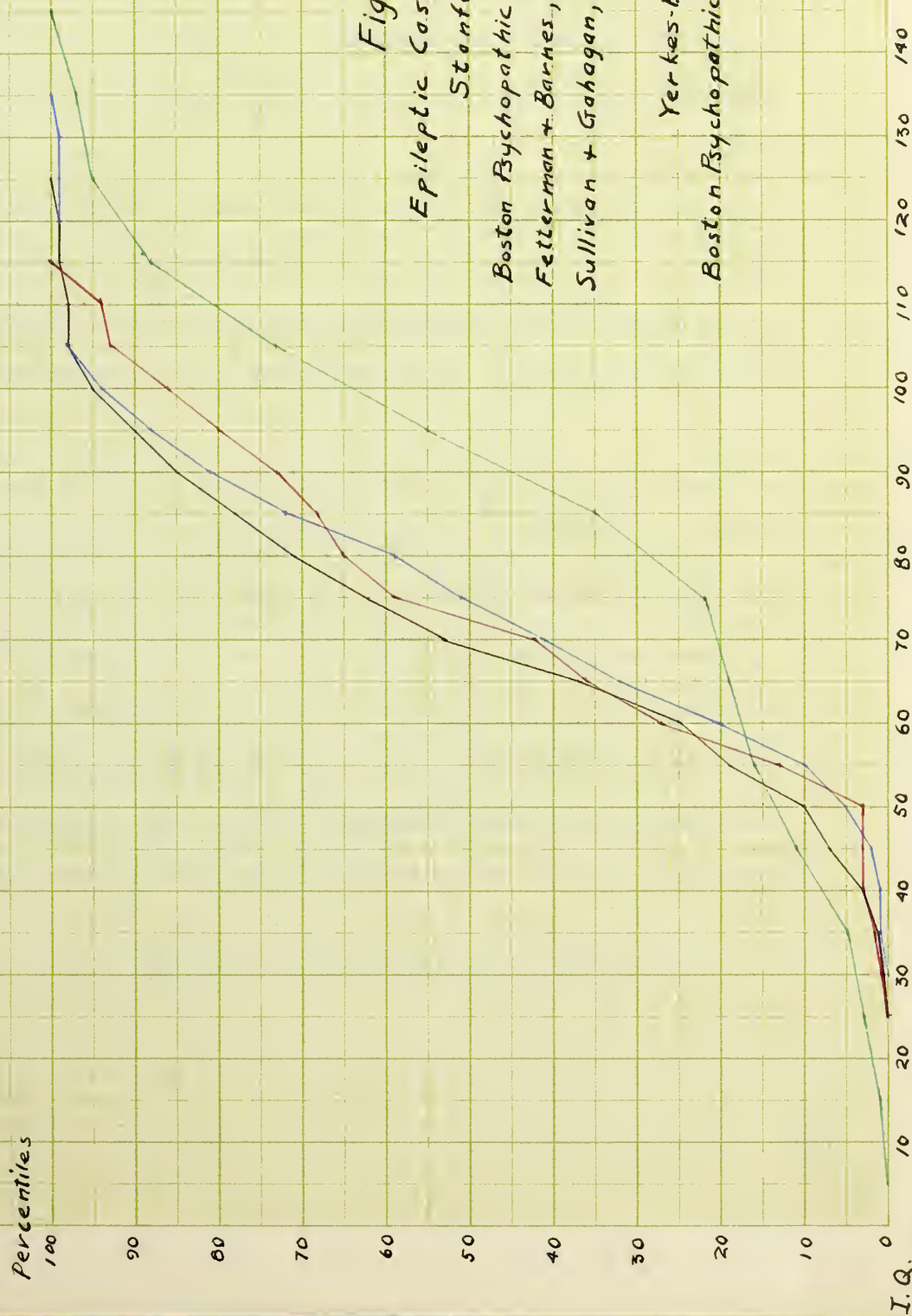*Stanford-Binet Scale*

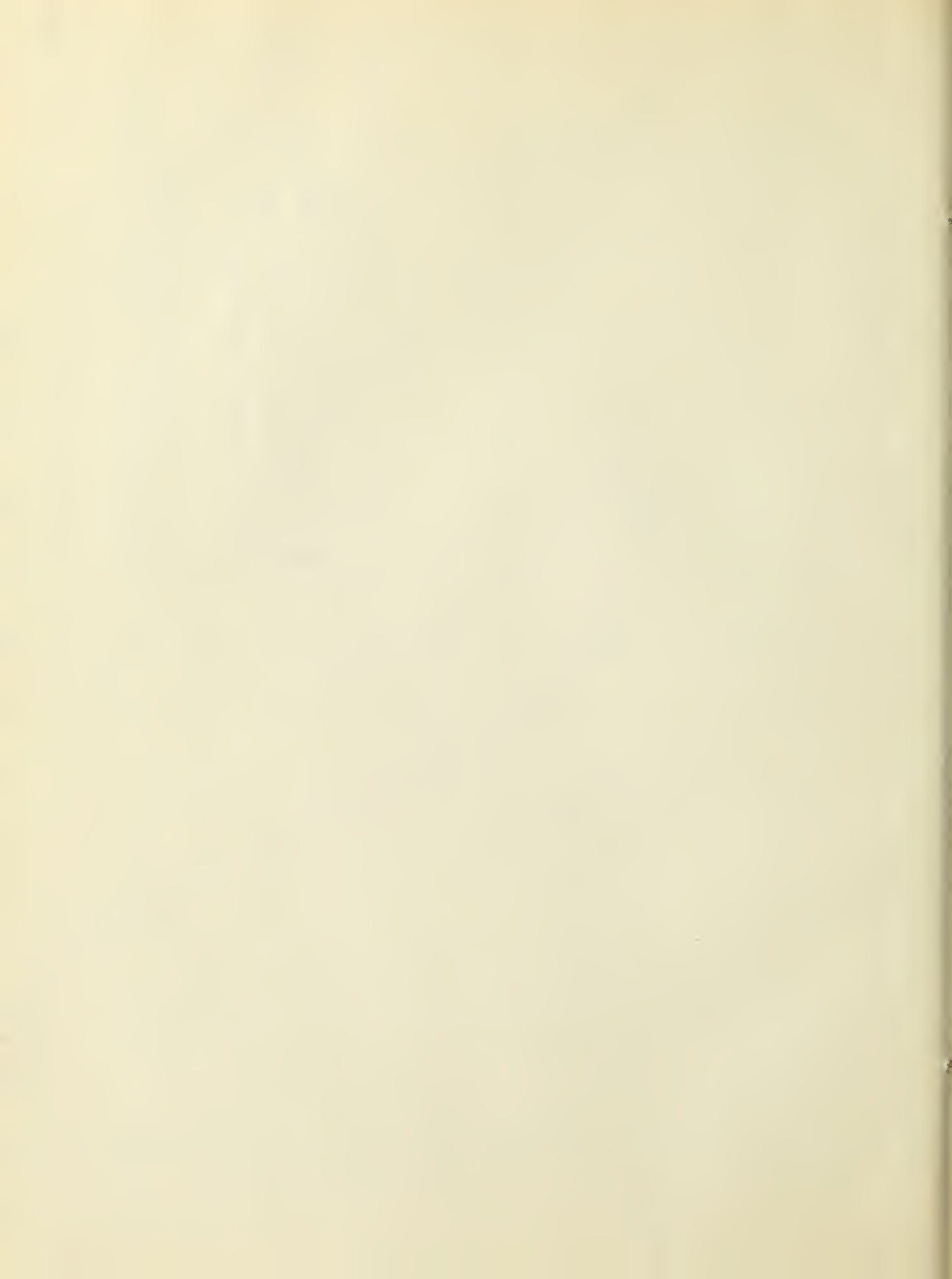Boston Psychopathic Hospital   229 cases
Fetterman + Barnes, Cleveland   105 cases
Sullivan + Gahagan, Los Angeles   103 cases

Yerkes-Bridges Point Scale
Boston Psychopathic Hospital   193 cases

Percentiles

I.Q.

hospital in 1918, compared schizophrenics with alcoholics, and found a much
higher degree of intelligence in the former. She accounted for it by the
fact that hallucinations and delusions appear in schizophrenia very early
in the course of the disease, and bring the patient into the hospital before
any intellectual effect is apparent; therefore a "clearing-house" like the
Psychopathic, gets only early cases. Paresis, like the alcoholism which
she cites, is a late manifestation of an underlying disorder of long stand-
ing, as is illustrated by the much higher average of chronological ages in
the paretic cases.

The implications are perhaps less clear in the case of epilepsy,
because of the following considerations:

1. The origin, whether organic or functional, of idiopathic
epilepsy, which includes the largest number of cases, is still a moot ques-
tion.

2. Epilepsy differs from the other two disorders under consider-
ation, in that it refers not to a disease entity, nor to a definite psychosis,
but to a syndrome of symptoms, both physical and mental, which in some cases
lead to psychotic results. It is the psychotic portion of the epileptic
population that becomes inmates of our state mental institutions. Accord-
ing to Doolittle[7], this proportion is about one-tenth; the other nine-
tenths are living a fairly normal and well-adjusted life in the world out-
side the institution. The out-patient department of the hospital deals with

(7) Doolittle, G. J. "The Epileptic Personality." Psychiatric
Quarterly, 1932, Vol. vi: 89-96.

some of these, the dispensary type of patient, but very little with those who are most intelligent and best adjusted[8]. Paskind[9] writes of this extra-mural, superior type of private patient, but most investigators, while recognizing its existence, find no data available for comparison. So that this study, while undoubtedly dealing with a quite representative group of paretics and schizophrenics, probably does not represent in due ratio, the epileptics who are least mentally affected by the disease.

3. There is a recognized difficulty in studies of epilepsy, in discriminating between epileptic effects and an innate feeble-mindedness, which has often been found to antedate the epilepsy[10]. This has been commented on more or less in recent work and is noted here for later discussion[11]. Dawson and Conn[12], for instance, quote Craig Colony figures as showing 75% mentally defective, 15% deteriorated, and only 10% normal. Monson[13] figures show 50% admissions feeble-minded.

(8) Talbot, F. B. Treatment of Epilepsy. The MacMillan Company, Boston, 1930. pp 16-17.
(9) Paskind, H. A. "Extra-mural Patients with Epilepsy." Archives of Neurology and Psychiatry, 1932, Vol. xxv: 19-32.
(10) Patterson, H. A. and Fonner, D. "Some Observations on the Intelligence Quotient in Epileptics." Psychiatric Quarterly, 1928, Vol. ii; 542-8.
(11) Collins, A. L., Atwell, C. R. and Moore, M. "Stanford-Binet Response Patterns in Epileptics." American Journal of Orthopsychiatry, 1938, Vol. viii: 51-63.
(12) Dawson, S. and Conn, J. C. M. "The Intelligence of Epileptic Children." Archives Diseases of Childhood, 1929, Vol. iv: 142-151.
(13) Stein, Calvert. "Hereditary Factors in Epilepsy." American Journal of Psychiatry, 1933, Vol. xxix: 989-1037.

Mental Age.

The mental ages of the subjects furnish the norms for comparison by which the specific abilities and disabilities of each are to be estimated. A wide range of capacity is found in each of the groups and a fairly normal distribution. The lower limits are 3 years, 6 months for the paretic group, 2 years, 6 months for the epileptic, and 5 years, 6 months for the schizophrenic. The ogive curves of the three distributions are shown in Figure 2.* As there are thirty-two children (below, 16, Terman's adult standard) in the epileptic group, whose mental ages, even though near their chronological ages, would unduly lower the median and average, and give an erroneous result, the graph comparison is made only with the one hundred and eighty-seven adult cases. Of these, the lower limit is 4 years, 6 months. The medians and the upper limits of the first and third quartiles (Q 1 and Q 3) are, in years and months:

	Q 1	Median	Q 3
Paretic	9-8	11-3	13-4
Epileptic, adults only	9-2	10-11	12-8
Epileptic, all cases	8-8	10-6	12-4
Schizophrenic	10-4	12-4	14-5

Computation of the averages gives for the paretic group, 11.44 years; for the epileptic, all cases, 10.64 years; adults, only, 10.93 years; and for the schizophrenic, 12.40 years. Applying the reliability formula to these results:

Paretic and epileptic adults	diff./ σ diff. = 1.95
Paretic and schizophrenic	diff./ σ diff. = 3.61
Epileptic adults and schizophrenic	diff./ σ diff. = 5.36

i.e., the differences between the schizophrenic and the other two groups are significant; the difference between the paretic and the epileptic is not.

* This graph shows for each mental age the percentage of cases that was below it.
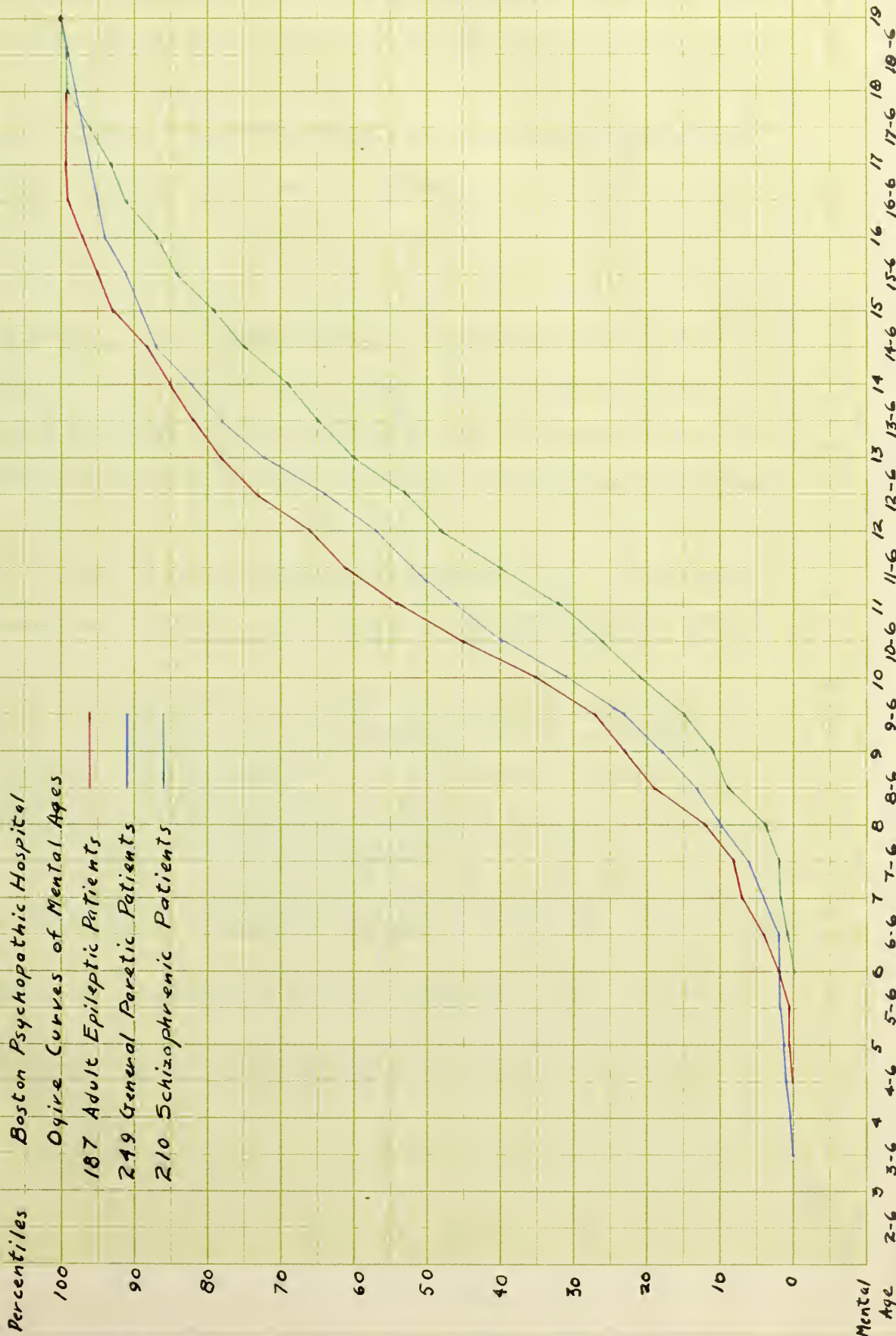
Figure 3

Boston Psychopathic Hospital
Ogive Curves of Mental Ages

187 Adult Epileptic Patients
249 General Paretic Patients
210 Schizophrenic Patients

Percentiles

100

90

80

70

60

50

40

30

20

10

0

Mental Age   2-6 3 3-6 4 4-6 5 5-6 6 6-6 7 7-6 8 8-6 9 9-6 10 10-6 11 11-6 12 12-6 13 13-6 14 14-6 15 15-6 16 16-6 17 17-6 18 18-6 19

Scatter.

The quantitative scatter studies, the first group in Malamud and Palmer's[1] classification, deal numerically with the significance of irregularity of test performance. This has been a much discussed question since Binet began testing. Binet[2] believed that the feebleminded scatter more than normals, and many investigators have agreed with him[3]. Wallin, among others, on the contrary, finds more scatter in normals[4]. There are similar contradictory expressions of opinion as to the scatter of psychotics compared to normals, as to relative scatter of children and adults, and of subjects of superior and inferior intelligence. Most of the more recent studies have been made with the Stanford-Binet; some of the earlier ones, Curtis,and Pressey,used the point scale and the Goddard version of the Binet-Simon[5].

The discussions have included, not only difference of opinion as to the amount of the scatter in various grades of mentality and in various

(1)   Malamud, W. and Palmer, E. M., op. cit. pp 69 f.
(2)   Binet, A. and Simon, Th. The Intelligence of the Feebleminded. Williams and Wilkins Company, Baltimore, 1916.
(3)   Woodrow, H. "Mental Unevenness and Brightness." Journal of Educational Psychology, 1928, Vol. xix: 298-302.
        McFadden, J. H. "Differential Responses of Normal and Feeble-minded Subjects." Mental Measurement Monographs, 1931, Vol. vii: 85. Cited by Harris and Shakow.
(4)   Wallin, J. E. W. "Intelligence Irregularity as Measured by Scattering in the Binet Scale." Journal of Educational Psychology, 1922, Vol.xiii: 140-151.
(5)   Curtis, J. N. "Point Scale Examinations on the High-Grade Feeble-minded and the Insane." Journal of Abnormal Psychology, 1918, Vol. xiii: 77-118.
        Pressey, S. L. "Distinctive Features in Psychological Test Measurements." Journal of Abnormal Psychology, 1917, Vol. xii: 130-139.

forms of psychosis, but also differences as to its diagnostic value, and as to the best methods of computation. Mateer[6] is one of the chief proponents of the value of scatter in diagnosis, but was a little less positive in a later work[7] as to the criteria to be adopted. Porteus[8] and Wallin[9] are more skeptical of the significance of the scatter though not doubting the fact. Foster[10] and Wells and Kelley[11], differentiating types of psychoses, found more irregularity in adults in the disorders of organic origin, particularly those due to syphilis. Wells'[12] later work confirms this, but he is not inclined to put stress upon the significance in children; and he definitely warns against considering scatter as always pathological.

As to methods of computing scatter, Harris and Shakow[13] have very recently assembled and analyzed studies in the field, including in their summary several unpublished papers. Their conclusions, very briefly summarized, are that there are three main groups into which methods of measuring scatter fall:

(6) Mateer, F. "The Future of Clinical Psychology." Journal of Delinquency, 1921, Vol. vi: 283-293.

(7) Mateer, F. The Unstable Child. New York, D. Appleton-Century Company, 1924. pp xii + 471.

(8) Porteus, S. D. Studies in Mental Deviation. Vineland N. J. Training School Publications Dept. Research, 1922, 24, pp xi + 276.

(9) Wallin, J. E. W. "Intelligence Irregularity as Measured by Scattering in the Binet Scale." Journal of Educational Psychology, 1922, Vol. xiii: 140-151.

(10) Foster, J. C. "Significant Responses in Certain Mental Tests." Journal of Applied Psychology, 1920, Vol. iv: 142-154.

(11) Wells, F. L., and Kelley, C. M. "Intelligence and Psychosis." American Journal of Insanity, 1920, Vol. lxxvii: 17-45.

(12) Wells, F. L. Mental Tests in Clinical Practice. 1927. World Book Company, Chicago. pp 61 and App. Twelve.

(13) Harris, A. J. and Shakow, D. "The Clinical Significance of Numerical Measures of Scatter in the Stanford-Binet." Psychological Bulletin, 1937, Vol. xxxiv, No. 3: 134-150.

1. Age level scatter; this counts the number of test levels over which successes were spread and shows the range of the scatter.

2. Wallin[14] scatter, which counts the total months' credit earned above the basal age; and Wells'[15] method of using the sum of the passes above and failure below the mental age level; both of these give the area of the scatter.

3. More elaborate statistical processes; these include Pressey's[16] method of weighting passes and failures in proportion to the distance from the mental age, and methods using a standard deviation basis of computation, of which Woodworth's[17] is perhaps the most quoted example; these are indicative of the regularity of the scatter.

Harris and Shakow find, in general, that results differ somewhat according to the test used, and the measures of scatter adopted; also that the relative merits of these measures have not been authoritatively determined, and therefore valid conclusions cannot be drawn. Their most positive finding is that some of the measures are definitely related to mental age, and that the results of studies using them cannot be clearly interpreted unless mental age is controlled.

A later study[18] by the same authors, compares groups of schizo-

(14) Wallin, J. E. W. "Intelligence Irregularity as Measured by Scattering in the Binet Scale." Op. cit. pp 140-151.
(15) Wells, F. L. "Mental Tests in Clinical Practice." Loc. cit.
(16) Pressey, S. L. and Cole, L. W. "Irregularity in a Psychological Examination as a Measure of Mental Deterioration." Journal of Abnormal Psychology, 1919, pp 285-294.
(17) Woodworth, R. S. "Computing the Standard Deviation and Probable Error of a Binet Mental Age." Psychological Bulletin, 1928, Vol. xxv: 167.
(18) Harris, A. J. and Shakow, D. "Scatter on the Stanford-Binet in Schizophrenic, Normal and Delinquent Adults." Journal of Abnormal and Social Psychology, 1938, Vol. xxxiii, No. 1:pp 100-111.

phrenic, normal and delinquent adults, using four different measures of
scatter (age-level, Woodworth, Pressey, and Wallin scatter). They find the
Pressey scatter superior, because of higher correlation with the other mea-
sures and with clinical findings, and because of less dependence on mental
age. They assert that, of the various factors considered in the study,
psychotic condition, delinquency, age, education, occupation, attitude,
hospitalization period, and mental age, only the last named was related
significantly to the amount of scatter. They suggest the need, long recog-
nized in psychometric studies, of records of an adequate sampling of normal
adults, but also admit the great difficulty of obtaining them; they also
note the limitation of the Stanford-Binet scale in the upper level, the
"ceiling" of the scale, and express the hope that the new revision[19] will
remedy this deficiency with its tests at every year level, and its more ex-
tensive superior adult range. The age level method of computing scatter may
then prove the more valid.

The scatter computation used by the writer in this study conforms
to some extent to age level scatter, in that it deals with range only, not
with area nor regularity, but differs from it in an attempt to recognize
the two-year intervals of the upper Stanford; it adopts the simple rough
measure of counting and tabulating the number of years, rather than test
levels, from the basal year where no tests are failed to the year of complete
failure where none are passed. This process has the virtue of simplicity
and of freedom from the complicated procedures of the third group described,

(19) Terman, L. M. and Merrill, Maude. Measuring Intelligence. Boston: Houghton
Mifflin Company, 1937: pp xiv + 461.

which it resembles only in recognizing the larger intervals of the upper
scale. The Boston hospital figures of the three distributions, thus ob-
tained, are given in Table 2, also the averages of the three groups ex-
pressed in terms of years of scatter, and the reliability quotients, com-
puted by the diff./ σ diff. formula. These facts may be noted: - that the
paretics have the largest amount of scatter; that none of the reliability
figures reach the level of significance; that the difference between the
paretics and epileptics is fairly near the significance criterion, that
between the paretics and schizophrenics is less significant and that be-
tween the epileptics and schizophrenics shows the smallest figure.

The limitations of the Stanford scale seemed to the writer to
give an inaccurate picture of the possible scatter of the patients of higher
intelligence; i.e. there was no certainty that those who passed any 18-year
test could not have gone on to still higher levels, had the scale provided
them. Likewise, the few who failed any three-year test, might have been
unable to perform still easier tasks than any in the list. To test this,
a further computation of scatter was made, using only the records of pa-
tients who had no failure at three and no pass at 18. The averages and
reliability quotients of these are also given in the table. This shows
that the average variability increased in the schizophrenic group, without
the upper level tests (there were no 3-year failures), and decreased in the
other two. The percentages of each distribution which were eliminated were:
schizophrenic, 37%; paretic, 21% (only 3 low failures) and epileptic, 16%
(2 low failures). It seems somewhat questionable whether this increase in
accuracy of counting the scatter is of sufficient importance to overcome

Table 2.

Scatter.

Years scatter	Paretic*		Epileptic*		Schizophrenic*	
	all*	3-16	all	3-16	all	3-16
3	6	1	6	4	6	0
4	4	4	7	6	4	4
5	25	15	15	13	20	7
6	6	6	21	21	10	10
7	40	32	49	38	40	23
8	20	19	33	30	26	26
9	61	55	44	37	41	29
10	43	29	25	20	35	22
11	38	31	16	11	19	8
12	3	2	6	4	7	3
13	3	3	6	6	1	
14						
15					1	
16			1	1		
						132
Total cases	249	197	229	192	210	132
Average	8.46	8.32	8.04	7.95	8.20	8.22

Reliability of Results.

Gen. Par. & Epi.	all	diff./ σ diff. = 2.11
	3-16	diff./ σ diff. = 1.89
Gen. Par. & Schiz.	all	diff./ σ diff. = 1.30
	3-16	diff./ σ diff. = .05
Epi. & Schiz.	all	diff./ σ diff. = .75
	3-16	diff./ σ diff. = 1.30

* The first column under each group gives the scatter figures for all the cases, the second only for those with no failure in the three-year scale and no pass at eighteen.

the disadvantage of leaving out of consideration the superior mentalities;
i.e. the revised table is a measure of the scatter of the lower ranges of
intelligence of the groups, not of the groups as a whole.

An attempt was also made to see if, in these groups, there was
any evidence as to the relation between scatter and mental age. No elab-
orate computations were undertaken, but a suggestion of trends was sought
in a comparison of the scatter in the four quartiles of each mental age
distribution. Table 3 gives a tabulation of the medians of these quartiles.

Table 3.

Medians	Q 1	Q 2	Q 3	Q 4
Paretics	7.36	8.95	9.64	8.83
Epileptics	6.27	7.56	8.96	8.93
Schizophrenic	7.65	9.25	9.45	6.80

It is rather interesting to note that there is a steady increase
in the years of scatter for three quartiles in each distribution, and a
falling off in the fourth quartile, where the limitation of the ceiling of
the scale enters in. This is markedly true in the schizophrenic distribu-
tion, which has a much larger proportion of patients with passes in the
18-year scale. The result suggests agreement with two of Harris and
Shakow's findings, that of a relation of dependence between scatter and
mental age, and that of inadequacy of upper level measures of scatter in
the present scale.

The evidence furnished by this study as to the value of scatter
in diagnosis is seen to be very slight; the study thus conforms to the find-
ings of many investigators, viz. little importance in results, and lack of
valid criteria, until further research furnishes reliable normal adult sam-
plings for comparison. Such little evidence as is shown seems to conform
to the view of the greater scatter in the organic psychoses.

Analysis of Responses.

The second type of deterioration study, dealing with specific rather than general effects of the psychosis on intelligence, requires an analysis of the responses to the different types of sub-test. The method adopted for this analysis is based on a comparison of the success or failure of each subject in each response, with the result to be expected at his mental age. A tabulation was made showing the mental age of every subject and his score, passed or failed, on every test that was given to him. Such of these scores as were above or below the mental age of the subject were then checked and counted, and the percentages of the whole number of cases were computed. These percentages form the material of the analysis. Table 4 gives a tabulation of the numbers and percentages of these scores that were above or below the mental age level.

Certain details of the method and certain assumptions that were made, require some comment and explanation:

1. The subject's mental age is considered as representing the level at which he was functioning, and below which all tests should, according to reasonable expectation, have been passed. It should be noted that all the tests of a designated year level must be passed to give a rating at that year; therefore, for example, if the mental age is any figure from 10-1 to 12, inclusive, the subject is assumed to be working in the 12-year scale, and any tests passed at the levels from 14 years up, are passed above age, and any in the scales for 10 or below that are failed, are failed below age; neither success nor failure in the 12-year scale would be considered.

2. The percentages of success above and failure below mental age,

were percentages computed of the whole number of cases (i.e. always 249 pa-
retics, 229 epileptics, and 210 schizophrenics;) this makes the customary
Stanford assumption that all tests below the basal year are presumptively
passed, and all above the limit of complete failure are presumptively failed.
It seems a valid assumption to make, except possibly in the case of alternate
tests that were not given, at levels near the mental age. Some of these alter-
nates are digit repetition tests, and are given in such large numbers as to
justify their inclusion; two are sentence repetition, of which a fairly large
number were given, and which showed similar trends to the memory tests of the
regular list; the others will be indicated in the discussion as of more doubt-
ful significance when few were given.

    3. The mental ages are computed according to regular Stanford
procedure, and alternates do not enter into the computation unless some tests
of the regular list were not given. The fact that an alternate test does
not always enter into the make-up of the mental age obtained, but is counted
in the percentages of failure and success, is assumed not to invalidate the
comparison.

    In some of the studies in this field, much stress is put upon the
need of controlling mental age in selecting subjects, if results of statis-
tical comparison are to be valid. Many experimenters feel that the results
noted are often a function of the mental age rather than significant indica-
tors of pathological scatter in abilities, e.g. the scatter studies of Harris
and Shakow[1]. Therefore they use for comparison selected groups of subjects

    (1) Harris, A. J. and Shakow, D. "The Clinical Significance of Numeri-
cal Measures of Scatter." Psychological Bulletin, 1937, Vol. xxxiv, No. 3:
134-150 (continued at the bottom of the next page).

matched for mental age. In this study, the design is to work with entirely

unselected subjects, but it is considered that this factor is controlled by

the method adopted of counting success and failure scores on the sub-tests

only as they are related to mental age.

This comparison of specific results in each test with mental age,

as shown in Table 4, is investigated in connection with the different types

of sub-test, and of the mental functions involved. Some tests are distinct-

ly memory tests, some involve speed of reaction, a few are of the perform-

ance test order, some seem to include more than one function. The analysis

of the test results is made under the head of the mental function to which

each test seems best to apply.

"Scatter on the Stanford-Binet in Schizophrenic, Normal and Delin-
quent Adults." Journal of Abnormal and Social Psychology, 1938, Vol. xxxiii,
No. 1: 100-111.

Table 4.

Tests	Number given			Number passed above M.A.			Number failed below M.A.			Percent passed above M.A.			Percent failed below M.A.		
	G.P.	Ep.	Sz.	G.P.	Ep.	Sz.	G.P.	Ep.	6z.	G.P.	Ep.	Sz.	G.P.	Ep.	6z.
3 -1 Features			1												
2 Objects							1								
3 Pict. omm.	219	216	166											.5	
4 Sex	5		1				1						.5		
5 Name	9						1	1					.5	.5	
6 Sent. 1	11		6				3	1					1	.5	
A-1 3 dig. for.	246	207	205				2	1					1	.5	
4 -1 Lines	10	16	3				1	1					.6	.6	
2 Forms	9	15	3				1	2					.6	1	
3 4 pennies	10	17	3				1	1					.5	.5	
4 Square	10	16	3				1	1					.5	.6	
5 Comp. 1	12	15	3				1	1					.5	.5	
6 4 dig. for.	248	207	205				5	6					1	4	
A-1 Sent. 2	11	13	3				1	2					.5	1	
5 -1 Weights, 2	21	31	7				1	4					.6	2	
2 Colors	21	31	6				3	6	1				1.5	2	.6
3 Aes. Comp.	19	30	6	1			2	5	2	.6			1	2	1
4 Def. use	20	30	6					1	2		.5			.5	1
5 Rectangle	19	28	5	1				6	1	.5				3	.5
6 Commission	13	16	6				1	4	3				.5	2	1.5
A-1 Age	11	13	1			1	1	1							
6 -1 Rt. & Lt.	35	43	9	2			1	5		1			.5	2	
2 Mut. pict.	36	44	10	1			7	7	3	.5		1	3	3	1.5
3 13 pennies	32	42	9	2	2		1	1		1	1	.5	.5	.5	
4 Comp. 2	32	42	12	2	1		2	3	3	1					1.5
5 Coins	32	31	7	3	2			1		1	1			.5	
6 Sent. 3	40	47	17	2	2		10	11	1	1	1		4	5	.5
A-1 A.M. & P.M.	6	16	5				1	1	2				.5	.5	1.
7 -1 Fingers	66	72	44	1	4					.5	2				
2 Pict. des.	229	216	186	2	1		2	2	2	1	.5		1	1	1
3 6 dig. fbr.	244	206	205		1		19	12	5		.6		7.5	5	2.5
4 Bow-knot	44	36	19	1			3	2		.5			1	1	
5 Diff. con.	64	74	44	1	2		9	7	1	.5	1		3.5	3	.5
6 Diamond	81	62	39				9	9	4				3.5	4	2
A-1 Days of week	17	35	26	1	1		1	2		.6	.5		.5	1	
2 3 dig. back.	243	216	210		2		9	11	5		1		3.6	6	2.5
8 -1 B. & F. Inf.	225	169	165		3		16	26	29		1		6.5	11	14
2 Count back	159	139	67	6	5		6	3	2	2.5	2		2	1	1
3 Comp. 3	161	141	93	3	4		12	6	6	1	2		5	2.6	3
4 6im. 2	162	141	95			1	17	13	6		.6		7	6	4
5 Def. sup. use	155	134		1	4	2	5	6	2	.5	2.6	1	2	2.6	1
6 Vocab. 20	246	216	209	1	3		4	6		.6	1		1.5	2.5	
A-1 Coins 6	10	9	1				2	1		1	.5			.5	
2 Dictation	12	9	4			1		2			.5		1		1
9 -1 Date	175	159	113	11	5	3	21	12	21	4.6	2	1.5	8.5	6	10
2 Weights, 6	166	154	114	5	2	1	73	31	30	2	1	.5	29	14	14
3 Arith. 1	166	193	129	14	12	4	7	7	2	5.5	6.5	2	3	3	1
4 4 dig. back.	243	217	210	1	2		49	36	28	.5	1		20	17	13
5 3 words	186	159	151		2	1	26	17	9		1	.5	10	7	4
6 Rhymes	156	131	119		2	1	65	22	26		1	.5	22	10	13
A-1 Months	67	63	55	1	6	2	3		4	.5	3	1	1		2
2 Stamps	15	14	16	2	3		2	1	1	1	1		1	.5	.5
10 -1 Vocab. 30	246	216	209	17	6	6	1	2	1	7	3	4	.5	1	.5
2 Absurdities	209	166	159	4	4		26	16	33	6.5	2		10	7	16
3 Designs	209	179	162	1	5		102	56	67	.5	2		41	26	32
4 Road & Rep.	167	160	146	2	3	2	56	31	35	1	2	1	23	14	17
5 Comp. 4	213	163	156	13	9	7	4	15	12	5	4	3	1.5	7	6.5
6 60 words	53	51	31		3		7	9	9		1		3	4	4
A-1 6 dig. for.	225	165	197	5	5	7	36	31	26	2	2	3	15	14	12
2 Sent. 4	74	61	56			4	24	17	16			2	9.5	6	6.5
3 Healy A	12	45	24	3	10	3	2	3	1	1	4	1.5	1	1	.5
12 -1 Vocab. 40	246	216	209	26	5	10	2	4	2	11	2	5	1	2	1
2 Def. abs.	207	182	178	26	10	13	1	3	5	10.5	4	6	.5	1	2.5
3 B. & F. sup.	225	169	165	9	5	7	19	16	32	3.5	2	3	7.5	6	15
4 Diss. sent.	169	174	173	4	5	3	17	5	10	1.5	2	1.5	7	2	5
5 Fables, 4	216	166	176	1	3	1	26	10	26	.5	1	.5	10	4	12
6 5 dig. back.	226	192	201	3	4	2	32	15	16	1	2	1	13	7	7.5
7 Dict. int.	229	216	166	19	9	9	11	6	9	7.5	4	4	4.6	3.5	4
8 6im. 3 obj.	204	163	176	7	6	2	17	12	11	3	3	1	7	8	5
14 -1 Vocab. 50	246	216	209	41	12	26	1	4		16	5	12	.5	2	
2 Induction	197	145	161	23	33	17	2	5	11	9.5	15	6	1	2	6
3 Pros. & King	117	90	95	14	5	3	4	4	6	5.5	2	1.6	2	2	3
4 Prob. fact	212	156	177	34	27	18	2	10	9	13.5	12	6.6	1	4	4
5 Arith. 2	205	160	177	12	14	7	8	13	6	5	6	3	2	3.5	6
6 Rev. clock	167	144	161	8	19	10	5	6	17	2.5	6	5	2	3	6
A-1 7 dig. for.	191	140	161	9	13	15	9	7	16	3.5	6	7	3.5	2.5	7.5
16 -1 Vocab. 65	246	216	209	16	4	3	1	2	.	7	2	1.5	.5	1	
2 Fables	216	166	176	11	11	4		2		4.5	4.5	2		1	
3 Diff. abs.	170	116	154	16	6	4	2	1		6.5	3.5	2	1	.5	
4 Enc. boxes	166	119	149	16	20	12	3		6	7	9	5.5	1		3
5 6 dig. back.	176	126	161	7	13	13	3		3	3	5.5	6	1		1.5
6 Code	26	29	21			1	1	1			.5		.5		.5
A-1 Sent. 5	123	66	90	2		1	5	2	1	1	.5		2		1
2 Phys. rel.	31	16	45	4	2	2	2		1	2	1	1	1		.5
18 -1 Vocab. 75	246	216	209	11	5	7				5	2	3			
2 Binet	93	70	113	6	11	12				3	5	6			
3 6 dig. for.	91	69	119	14	16	30				5.5	6	14			
4 Tho't pass.	63	102	66	1	5	10				.5	2	5			
6 7 dig. back.	86	72	113	4	7	17				1.5	3	6			
8 Ingenuity	80	52	90	6	6	7				2.5	2.5	3.5			
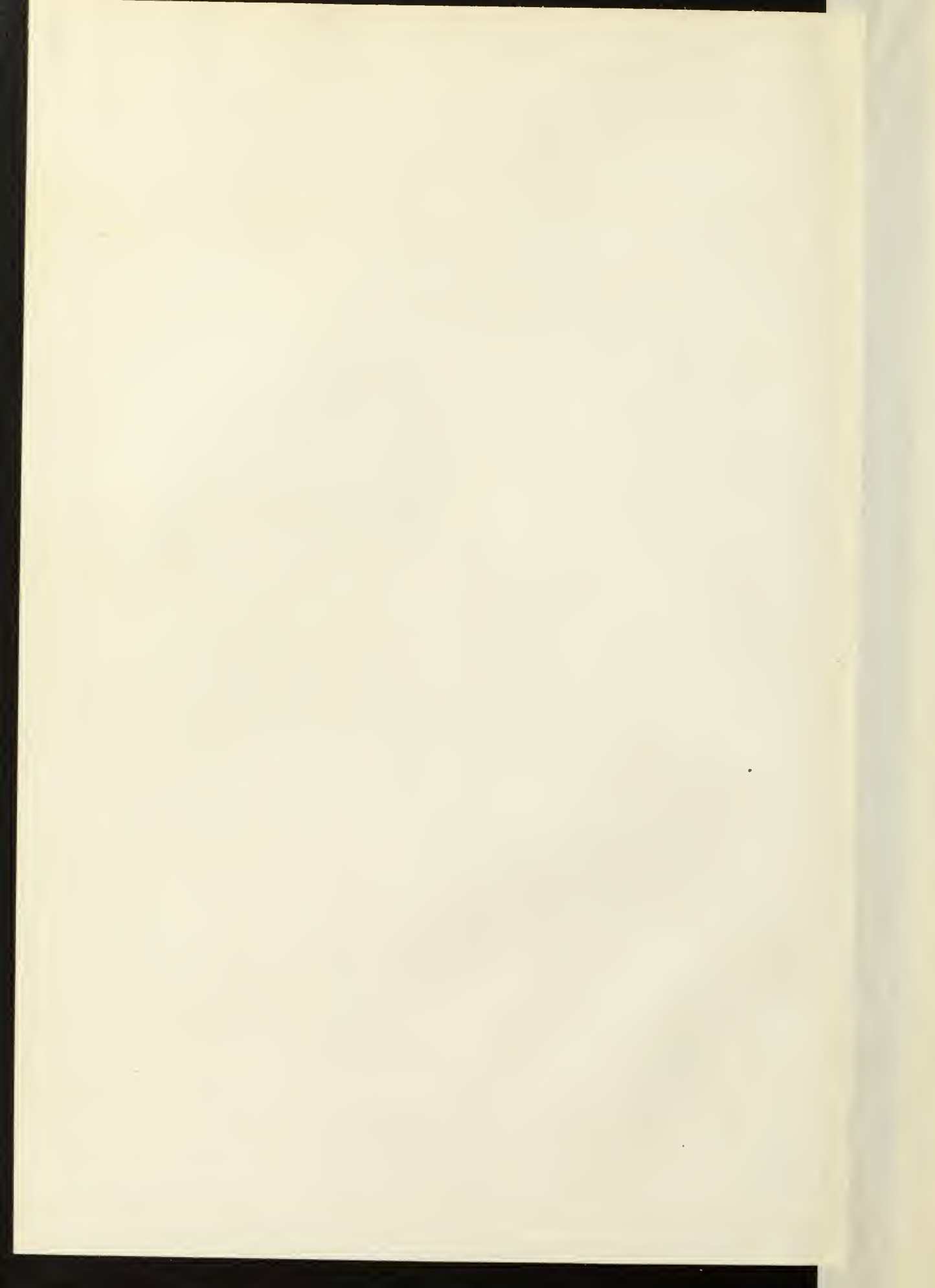
Memory.

Memory tests form a large part of most scales, including the Stanford, and there is rather general agreement that, in all forms of mental disease, memory tends to deteriorate below intelligence level. Foster[1], for instance, makes this statement definitely in an examination of Boston Psychopathic cases in 1920. There is also general agreement that memory failure is greatest in the organic group of psychoses; e.g. Kraepelin[2], discussing general paresis, finds retention and memory profoundly affected, particularly as to recent happenings; Rosanoff[3] considers amnesia an essential symptom of paresis; Henderson and Gillespie[4] find, as a common reaction-type of organic mental disorder in the intellectual sphere, a defect in retention and activation of memory; Wells and Martin[5] report the memory quotients of paretics as next to the lowest of all the groups studied (senile lowest). Remote memory is usually stated to be better than recent. Hunt's[6] summary of psychological experiments with psychotics reports many similar findings.

In the epileptic group, physiological factors are often emphasized, though not with the same insistence on organic origin as in paresis. Referring particularly to the physiological effects are Bridge[7], who suggests

(1) Foster, J. C. "Significant Responses in Certain Mental Tests."
Journal of Applied Psychology, 1920, Vol. iv: 142-154.
(2) Kraepelin, E. "General Paresis." (trans. by Moore, J. M.) Nervous
and Mental Disease Monograph Series, 1913, Vol. xiv, p 127 ff.
(3) Rosanoff, A. J. Manual of Psychiatry. New York. John Wylie and
Sons, Inc. 1920. pp 322.
(4) Henderson, D. K. and Gillespie, R. S. Text-Book of Psychiatry.
Oxford University Press. 4th edition. 1936. pp 304-5.
(5) Wells, F. L. and Martin, H. A. A. "A Method of Memory Examination
Suitable for Psychotic Cases." American Journal of Psychiatry, 1923, Vol.iii:
243-258.
(6) Hunt, J. McV. "Psychological Experiments with Disordered Persons."
Psychological Bulletin, 1936, Vol. xxxiii: 1-58.
(7) Bridge, E. M. "Mental State of the Epileptic Patient." Archives
of Neurology and Psychiatry, 1934, Vol. xxxii: 723-6.

autonomic disturbance, and Dorcus and Shaffer[8] who refer to the greater
disturbance of the higher, integrating, cortical centers. Both of these
emphasize particularly the effect of the convulsion on memory, i.e. temporary
failure of memory. Wooster-Drought[9] finds memory suffers more than general
mental functions, and memory for distant, more than for personal interests.
G. W. Smith[10], in an earlier study, distinguished two forms of memory
failure, which he named forgetting and confusion, (i.e. no response and
wrong response) and found the latter to increase more than the former with
the more deteriorated cases.

The schizophrenic group also show the confusion error, according
to Gatewood[11]. The general trend of memory investigations in this dis-
order seems to be toward the result found by Hull[12], that the schizophrenics
are least affected in the memory function, the paretics, most; and that it
is the stereotyped, laboratory type of test, that is easier for praecox
patients than tests that deal more with life situations.

In the Stanford scale, the digits repetition and sentence repeti-
tion tests are distinctly stereotyped, and test simply rote memory; digits
backward and counting backward (8-2) add a reasoning factor to the memory;
reading and report (10-4), and thought of passage (18-4) include comprehen-

(8)   Dorcus, R. N. and Shaffer, I. W. Text-Book of Abnormal Psychology.
Baltimore, Williams and Wilkins Company, 1934, pp 389.
(9)   Wooster-Drought, C. "Hystero-Epilepsy." British Journal of
Psychology. Medical Section, 1934, Vol. xiv: 50-82.
(10) Smith, G. W. "Comparison of Mental and Physical Tests." British
Journal of Psychology, 1904, Vol. i: 240-266.
(11) Gatewood, L. C. "Experimental Study in Dementia Praecox."
Psychology Monographs, 1909, Vol. xi, 45: pp 87 ff.
(12) Hull, C. L. "The Formation and Retention of Associations among
the Insane." American Journal of Psychology, 1917, Vol. xxviii: 419-439.

sion and verbal expression with the memory; designs (10-3) and code (16-6) are tests that might be considered to involve imagery and power of concentration as well as memory.

Table 5 gives the Boston percentages in the digits tests, assembled from Table 4.

The figures give the expected results with one exception to be noted; the schizophrenics show ability superior to the other groups in rote memory at all levels, with no low level failure and with more successes and fewer failures; the only exception to this is 14-year digits, where the failure figure is double that of the paretics and three times that of the epileptics; however, as the success figure is also double that of the paretics, it may indicate more variability rather than more inferiority at that level.

The digits backward tests show about the same relationships in the groups as digits forward - the failure figures are a little larger, the success a little smaller. The sentences of the 10-year level show the same trends even more clearly.

The largest failure figures in all of these, as in many of the tests, are in the middle range of the scale, the passes above age are in the upper level tests. There can, of course, be no failure below age at eighteen, and no success above age at three, in accordance with the conditions of the computation, and the middle range is best adapted to show contrasts. There may be noted here a tendency, apparent in various other tests as well, of the epileptic cases to show more improvement towards the upper level.

As to other memory tests, too few of the commissions test at 5-6

Table 5.

Digits Forward

Digits Test	% Passed above M.A.			%Failed below M.A.		
	Par.	Epi.	Schiz.	Par.	Epi.	Schiz.
3 3-Al				1 %	.5%	
4 4-6				1 %	4 %	
5 7-3		.5%		7.5%	5 %	2.5%
6 10-Al	2 %	2 %	3 %	15 %	14 %	12 %
7 14-Al	3.5%	6 %	7 %	3.5%	2.5%	7.5%
8 18-3	5.5%	8 %	14 %			

Digits Backward

Digits Test	Passed above M.A.			Failed below M.A.		
	Par.	Epi.	Schiz.	Par.	Epi.	Schiz.
3 7-Al		1 %		3.5%	5 %	2.5%
4 9-4	.5%	1 %		20 %	17 %	13 %
5 12-6	1 %	2 %	1 %	13 %	3 %	7.5%
6 16-5	3 %	6 %	6 %	1 %		1.5%
7 18-5	1.5%	3 %	8 %			

Sentence Memory

Tests	Passed above M.A.			Failed below M.A.		
	Par.	Epi.	Schiz.	Par.	Epi.	Schiz.
3-6				1 %		
4-Al				.5%	1 %	
6-6				4 %	5 %	.5%
10-Al			2 %	9.5%	8 %	8.5%
16-Al	1 %		.5%	2 %		1 %

were given for significance. The thought of passage is one of the most difficult in the scale, requiring immediate recall, as well as concentration and comprehension, and is at the eighteen-year level where no failure below age is possible; there were found only one paretic (.5%) to pass it above M.A., five epileptics, (2%) and ten schizophrenics, (5%) illustrating again the greater memory deterioration of the organic psychoses. The code, always difficult, showed one epileptic success, and one failure below age in paretics and schizophrenics even at the high 16-year level.

The largest failure figures of the study are in the ten-year list, where a large number of tests were given, and where the memory function is much involved. The reading and report at 10-4, shows 23% of failure below age in the paretics, 14% in the epileptics, and 17% in the schizophrenics, and only 1% of passes above age in the first two, none in the praecox. A small part of this failure might be in the reading and due to such an environmental factor as lack of school training, or to a possible non-reader subject; but general testing experience has usually found it in the report, i.e. a memory failure; (the writer has found only one failure in her testing experience due to the reading). This result seems to furnish additional evidence of greater memory failure in the organic psychoses, though there is a noticeable amount of failure in dementia praecox and epilepsy. The clinical psychiatrist might be inclined to attribute part of the schizophrenic failure to attitude and affective causes; these, however, are beyond the range of statistical evaluation.

Finally, the designs (10-3) result in the largest failures of all. Institutional experience has usually shown this to be very difficult for

psychotic adults. A few dissent - e.g. Fox[13] found designs easy for epileptics, and Altman and Shakow[14] (vide infra, p. 44) found this test, 10-3, one of those easier for schizophrenics than for normals matched for mental age. In this study, designs show the large failure figure below age of 41% (102 cases) in the paretics, 25% (58 cases) in the epileptics, and 32% (67 cases) in the schizophrenics, with negligible success figures (the epileptic 2% the largest, and none in the praecox list). A discrepancy as large as this seems almost to imply that the test is wrongly placed and should be at a higher level. Porteus[15], who found similar results in testing psychotics at Vineland, did change the order and place it at the 12-year level. Terman[16], however, in his large experimental group in California, found that the test was passed by from 2/3 to 3/4 of ten-year old school children. This is a case where a large sampling of normal adult scores would aid in interpretation. There is a possibility that the failure is not due entirely to the psychosis, but that the test is for some reason, more difficult for adults than for children. However, the failure seems too large to be wholly accounted for by normal adult inadequacy; not only did nearly half of the paretic group fail it below mental age, but, of the whole 201 paretics of any mental age who were given the test, only 32

(13) Fox, J. Tylor. "Mental tests for Epileptic Children." British Journal of Psychology. Medical Section, 1924, Vol. iv: 235 ff.

(14) Altman, C. and Shakow, D. Comparison of Schizophrenic, Normal and Delinquent Subjects. Journal of Educational Psychology, 1937, Vol.xxvii: 519-529.

(15) Porteus, S. D. "Studies in Mental Deviation." Vineland Training School Research, 1922, Vol. xxiv: pp xi + 276.

(16) Terman, Lewis M. Measurement of Intelligence, op. cit. p 37.

passed it, and 169 failed.* The percentage is decidedly smaller in the

schizophrenic group, and the epileptic failure figure is not much more than

half the paretic, though failure is striking in all. This test result seems

to furnish valid evidence of memory deterioration below the intellectual lev-

el in psychosis, and most marked evidence of the greater deteriorating ef-

fects of the recognized organic disorder.

Two of the groups manifest interesting differences in the discrep-

ancies between the two types of memory tests in this ten-year scale. This

designs test adds a performance feature to the memory in the execution of

the drawing; the digits is simply rote memory. The discrepancy between the

two is marked in the schizophrenic group; the failure percentage in designs

is almost three times as large as in digits with no success in the former,

3% in the latter. The epileptic failure in designs is less than double the

*It might be of interest to compare the scores obtained on this
test by the writer in a series of 54 Stanford tests given to normal subjects,
most of whom were public school children in an industrial city, perhaps a
fairly good, though small, normal sampling of children.

                Test 10-3. Results with normal subjects
    No. with M.A. 10-1 or above - - - - - - - - - - - - - - - - - 26
    No. with M.A. 9-1 to 10 - - - - - - - - - - - - - - - - - - - 8
    No. with M.A. 9 or below - - - - - - - - - - - - - - - - - - 20

        Test 10-3 not given, below basal - - - - - - - - - - - 5
        Test 10-3 not given, above failure level - - - - - - 9

    Passed at mental age - 5
    Failed at mental age - 3

        Passed above mental age (4% of 54) - - - - - - - - 2
        Failed below mental age (4% of 54) - - - - - - - - - 2

Of those whose chronological age was 10 to 10-11, 8 passed the test,
and 4 failed it, the Terman proportion.

digits failure with the same 2% of success in both. It is perhaps slightly illustrative of the greater failure of the functional group of psychotics in performance tests, referred to by some writers as characteristic of the type of disorder.

Speed.

Slowness and retardation are often mentioned as an important ef-
fect of psychosis, particularly if of the organic type, by writers from
Kraepelin[1] and Ziehen to the most recent. Wells and Kelley[2], in ex-
perimental work at McLean found reaction-time usually lengthened in psycho-
ses, and most of all in those of organic origin. Wooster-Drought and Doo-
little, Gowers of the older school, Abadie in France, Jung with his as-
sociation test, all find it a prominent feature of epilepsy[3]. Wentworth[4],
in testing schizophrenics, goes so far as to suggest that time limits should
not be observed, because the thought processes are so slowed by the affec-
tive and volitional character of the disease.

The part that speed of performance should play in the estimation
of intelligence has been at times a subject for debate. Freeman[5] main-
tains that speed contributes little in the understanding of the higher and
more complex mental processes, and that the more modern trend is to make

(1) Kraepelin, E. "General Paresis." (trans. by Moore, J. M.) Ner-
vous and Mental Disease Monograph Series, 1915, Vol. xiv: 197 ff.
(2) Wells, F. L. and Kelley, C. M. "The Simple Reaction in Psycho-
sis." American Journal of Psychiatry, 1922, Vol. ii: 53-59.
(3) Wooster-Drought, C. "Hystero-Epilepsy." British Journal of
Psychology. Medical Section, 1934, Vol. xiv: 50-82.
Doolittle, G. J. "The Epileptic Personality." Psychiatric
Quarterly, 1932, Vol. vi: 89-106.
Gowers, W. R. Epilepsy. London: Churchill, 1881. pp xxiv + 320.
Abadie, J. "L'Epilepsie Psychique." Revue Neurologique, 1932,
Vol. i: 1201-2116.
Jung, C. G. Studies in Word Association. New York. Moffat Yard,
1919 (trans. by Eder). Chap. 4.
(4) Wentworth, M. M. "Two Hundred Cases of Dementia Praecox, Tested
by the Stanford Revision." Journal of Abnormal Psychology, Vol. xviii:
378-388.
(5) Freeman, Frank S. Individual Differences. Henry Holt & Co. New
York. pp 10.

less use of it in testing than was formerly the case. Babcock[6], on the other hand, makes speed a vital point in her study of efficiency index, and makes accurate timing a feature of nearly all her tests.

The Stanford-Binet tests that have a time limit, vary much in character, a fact that should be taken into consideration in evaluating their evidence. We note six classes of these:-

1. In the designs, 10-3, the time limit is only for studying the problem, not for its execution, and therefore is hardly to be considered in the question of reaction-time.

2. There are two timed tests of a motor character, bow-knot and dictation, 7-4 and 8-A-2, but so few of these were given, and the percentage of variation is so small (none in the schizophrenic group) that the result is negligible, both relatively and intrinsically.

3. Three timed tests involve the recall of familiar things, but very few were given of stamps, (9-A-2), and days of the week, (7 A-1) as they are alternate tests and very few were given. The months of the year (9 A-1) shows a little epileptic superiority and a very little support to the theory that the schizophrenic is less in touch with reality than the paretic.

4. The timed reasoning tests show a little variation in the arithmetic questions in 9-3 and 14-5; there is a little more success than failure in the paretics and epileptics, with very little difference in the two groups or in the two age-levels of the tests. The schizophrenic record presents

(6) Babcock, Harriet. "An Experiment in the Measurement of Mental Deterioration." Archives of Psychology, 1930, Vol. xviii, No. 117: pp 105.
Babcock, Harriet. "Intelligence Testing in Psychopathology." Journal of Applied Psychology, 1931, Vol. xv: 584-589.

the rather unexpected result of showing less success than the paretic at both levels, and more failure at 14, quite reversing the finding of Hunt[7] of superiority of the praecox over the paretic in formal reasoning. Perhaps it is the speed factor, as Wentworth[8] has suggested, rather than loss of reasoning capacity that prevents these patients from showing normal ability on these tests. The ingenuity test, at eighteen, where there can be no failure below age, belongs in this class; it shows a little success in all, the paretic being somewhat smaller than the others.

5. A fifth group, involving a combination of perception and reasoning, includes one low level test, two in the middle range and four in the upper scale. Very few rectangle tests (5-5) were given; the epileptic failure figure, the largest, is in keeping with the trend in this group to more
    in the lower,
failure, and more success in the upper scale. Counting backward (8-2), shows small percentages both ways in two groups and none at all in the schizophrenic.

The upper level tests in this group (clock, boxes, code) show varying trends that seem to suggest other factors than speed as more important for their analysis, and are discussed under other categories.

6. The timed linguistic tests are the ones that give the most evidence of retardation. The use of words in a sentence, (9-5) rhymes (9-6) and reading and report (10-4), are among the large failure figures of the study in the paretics, 60 words in three minutes (10-6) only a little less.

(7) Hunt, J. McV. "Psychological Loss in Paretics and Schizophrenics." American Journal of Psychology, 1935, Vol. Lxvii: 458-463.
    (8) Wentworth, M. M, Op. cit. p 386.

Epileptic and schizophrenic scores, while still on the failure side, are less striking and show a little success. These are the results that conform to the usual findings in this field, which Hunt[9] has well summarized, to the effect that all psychotics are slower than normals, that the schizophrenics are the slowest of the functional groups, and that organic types are the most retarded of all.

(9) Hunt, J. McV. "Psychological Experiments with Disordered Persons." Psychological Bulletin, 1936, Vol. xxxiii: 1-58.

Imagery.

All but one of the tests classed under the imagery category are upper level tests. The result of designs (10-3) has already been referred to as also evidence of the failure in immediate memory. The failure here in the epileptic group tends to contradict Fox's[1] view that designs and forms are among the tests that are easy for epileptics, and to conform to that of Bridge[2], that the group deals better with mathematical than with imaginative subjects. In the other two groups, the paretics show very great inadequacy, and the schizophrenics an entirely different result from that of Altman and Shakow[3], whose praecox subjects found this test easy to pass. Their study, recently published, was a comparison of groups of schizophrenics, normals and delinquents, 56 of each, matched for mental age. In this small normal sampling, they find the designs among the tests in which their schizophrenic subjects surpass their normal controls, a decided reversal of the Boston results, which, however, conform to most institutional experience with this test.

Induction (14-2), completely reverses the designs figure. In the epileptic group, it is the largest success figure above age in the study, except vocabulary, and hardly bears out Jung's[4] assertion of poverty of imagery in the epileptic. This success suggests that memory may be a more

(1) Fox, J. Tylor. "Mental Tests for Epileptic Children." British Journal of Psychology. Medical Section, 1924, Vol. iv: 235 ff.
 (2) Bridge, E. M. "Mental State of the Epileptic Patient." Archives of Neurology and Psychiatry, 1934, Vol. xvii: 723-726.
 (3) Altman, C. and Shakow, D. "Comparison of Schizophrenic, Normal, and Delinquent Subjects." Journal of Educational Psychology, 1937, Vol. xxviii: 519-529.
 (4) Jung, C. G. Studies in Word Association, chap. 4. New York. Moffit Yard Company, 1919.

important factor than imagery in the designs result. This induction score illustrates again the trend toward more success in the upper levels which is more marked in this group than in either of the others. There is more general agreement in results in this test; e.g. Altman and Shakow find induction another of the tests in which their praecox subjects surpass their normal controls, and Wentworth[5] reports that all but her most deteriorated group often pass it above mental age.

The Binet folding test (18-2) shows a percentage about one-third that of the induction in both the paretic and epileptic groups, but larger figures in the latter; undoubtedly the reason for the difference in the two tests is that so few of the 18-year tests were given, as the two seem very similar in nature. Many more were given to the schizophrenics and the two percentages in this group show less difference.

The reversed clock, (14-6) from the conditions of its administration (the subject is definitely instructed to visualize the clock dial) depends largely on imagery, plus an added reasoning factor. In this test, the epileptic group is much superior, with 8% passes above age, to 3% failure below; the paretic varies slightly both ways (2.5% and 2%); and the schizophrenic shows a fairly large failure figure, 8%, with 5% success, and the greatest variability.

More success in all three groups is shown in the enclosed boxes, (16-4) the epileptic superiority being most marked and also the continued upper level success trend of this group.

(5) Wentworth, M. M., op. cit. p. 380.

These last two tests and the code, of which too few were given for significance, involve a reasoning as well as an imagery factor; being timed tests they may also owe some of the failed responses to slow reaction-time.

These results, especially when combined with the rather large failure figures of the backward digits, seem to furnish evidence of inferior visual imagery in two of the groups; the epileptic success seems to depend largely on reasoning and the mathematical type of imagery.

Orientation.

Clinical findings of disorientation in the psychotic find some psychometric confirmation in this study. All but one of the tests that are classified in this category are very low level tests (name, 3-5; age, 5 A-1; sex, 3-4; morning and afternoon, 6 A-1), and very few were given, but even with the very small numbers, there was some failure below and no success above mental age except that one epileptic with a mental age below five, succeeded in telling his age. The date results (9-1) are interesting and significant, and, even in a diagnostic hospital with short periods of residence, show the loss of the realization of the passage of time, common to many psychotics. The schizophrenic figure, with failure below age more than five times that of the success above, is the largest, and seems illustrative of the tendency to loss of interest in social contacts and in the concerns of every-day life.

The failure figures might well be even larger but for one factor that could influence the more intelligent patients. They undoubtedly learn almost at the outset of their hospital stay that every clinical interviewer will surely ask the date. This realization might lead to a superficial if not an intrinsic interest in the question.

Comprehension.

The four comprehension tests, in four degrees (4-5, 6-4, 8-3, 10-5) show little or no variation from mental age in the lower scale, and more in the middle range, where, however, the paretics reverse success and failure in the eight and ten-year tests. In the other tests and in all groups, failure is consistently greater. Wells[1] comments on the fact that the material of these tests is little adapted for adults, a fact which might account for part of the failure through loss of interest, or resentment at childish subject matter.

In the picture tests, at the description level, 7 years, there is little variation from the mental age, but more at twelve, the interpretation level; success above and failure below are the same in the schizophrenics, the failure figure in the epileptic list is the same as in the schizophrenic, the success slightly less, while in the paretic list, with a failure figure almost the same as the other two, the success percentage is about double. A similar relation is apparent in the problems of fact (14-4), which is commonly regarded as one of the easiest tests for a normal adult: here the ratio of success above age to failure below is, in the paretic group, 13.5 to 1, in the epileptic, 12 to 4, and in the schizophrenic, 8.5 to 4.

The results in these tests, particularly the picture interpretation and the problems of fact, seem to furnish confirmatory evidence of the theory brought out in Hunt's[2] comparison of schizophrenics and paretics, and a

(1) Wells, F. L. Mental Tests in Clinical Practice, op. cit. p 45.
(2) Hunt, J. McV. "Psychological Loss in Paretics and Schizophrenics." American Journal of Psychology, 1935, Vol. xLvii: 458-463.

critique of the same by Squires[3], that the interest of the paretic, unlike that of the schizophrenic, is not withdrawn from his environment and that he does not lose contact with life.

In the fables tests, the striking feature is the difference in the two levels. In the twelve-year scale, the comprehension of the story is involved; at 16, the interpretation of the story and its application to life. Failure is marked at the concrete, and success at the abstract level in all three groups, a result that seems to contradict the usual claim of inability to generalize in the psychotic. In illustration of this, Bolles and Gold-stein[4] have recently analyzed schizophrenic behavior, not into different mental capacities, but into abstract and concrete behavior. Using various performance type tests, primarily color sorting, they find their subjects, who are largely deteriorated hebephrenics with long periods of hospitalization, to show a complete "lack of ability to assume the categorical abstract attitude"; they always, unlike normals, proceed in a concrete way. The explanation of the contradictory findings may lie in the differing types of test, though there are others of our Stanford list that show more success at an abstract level, or it may be due to the difference between the mental and the diagnostic hospital. Whatever the reason, the difference in results is rather striking and may well furnish material for further investigation and analysis.

(3) Squires, Paul C. Notes and Discussions. American Journal of Psychology, 1936, Vol. xlviii: 169-172.
(4) Bolles, Marjorie and Goldstein, Kurt. "A study of the Impairment of Abstract Behavior." Psychiatric Quarterly, Jan. 1938, Vol. xii: 42-65.

Judgment.

Tests involving judgment, fall naturally into the two classes of practical and ideational. In the former are primarily the two performance tests of the weights (5-1 and 9-2). The very large percentage of failure below age in the paretics is, of course, to be expected because of the organic involvement of the nervous system and its effect on the kinaesthetic sense. The percentage figure at nine years is 29% failure below age, one of the largest of the study, and twice that of the other two groups; success figures are all small and negligible. Of the other practical tests, the kinaesthetic element is only slightly involved in the ball and field (8-1 and 12-3), and not at all in physical relations (16 A-2). Too few of the last named were given for evaluation, which is to be regretted as the test would form an interesting means of comparison. In the ball and field at both levels, schizophrenic failure is double the paretic and much larger than the epileptic, and success is much less than failure in all. This probably depends on a factor of relation to reality, which is equally noticeable in the ideational tests.

In the ideational class, aesthetic comparison (5-3) and completion (6-2) in the lower scale show very few tests given and are therefore negligible. One of the very interesting findings of the study is the absurdities result, (10-2) with large failure figures in the paretics, 10%, and schizophrenics, 16%, and little or no success. The epileptic failure is less, 7% and the success, 2%, slightly more. These large percentages of failure below age seem somewhat contradictory to the success above age, already noted (under the comprehension category) in the problems of fact,

since both tests, whether classed as illustrating comprehension or judgment, seem to require somewhat similar mental processes. The apparent inconsistency can hardly be due to the possible emotional effects of the "blood-lustful" contents of the absurdities tests, commented on by Wells[1], since the first of the three problems of fact shows a similar feature. There is probably a significant intrinsic difference in the two tests; the problems of fact test gives evidence mainly of comprehension, the subject's contact with reality and interpretation in terms of life experience; also it is capable of expression very simply and in very few words; the absurdities test requires, not only a comprehension of the situation suggested, but also a weighing of conditions, a "directional control of thought", in Malamud and Palmer's[2] words. These authors amplify their discussion of this phrase, as meaning the adjustment, attitude, and mental set, which are necessary for adaptive thinking. If the absurdities require this, they are truly tests of judgment, while the problems of fact imply comprehension only.

In general we find in this category:-

that failure below age is much more marked than success above in all three groups;

that in practical judgment, the largest failure in the kinaesthetic tests is in the organic psychosis;

that the ideational judgment tests show most failure in the schizophrenic group, least in the epileptics;

(1) Wells, F. L. Mental Tests in Clinical Practice, op. cit. p 49.
(2) Malamud, W. and Palmer, E. M. "Intellectual Deterioration in the Psychoses." Archives of Neurology and Psychiatry, 1938, Vol. xxxix: 68-81.

that there seems to be a confirmation of the finding that there is less directional control of thought in the schizophrenic.

Perception.

There are several tests, all but one below the 9-year level, that depend on sensory perception, lines (4-1), forms, (4-2) and colors (5-2); also drawing square and diamond (4-4 and 7-6), which are performance as well as perception tests. The mental ages of very few patients were so low as to require the giving of these. There are only failure figures, and those of the epileptics are somewhat larger even in the performance tests where the neural effects of paresis might be expected to cause loss of motor control.

The situation is reversed in the 9-year weights, where the failure of the paretic, as has been noted is much larger and suggestive of the neural effect of the physical disease back of the disorder. There has been much difference of opinion as to the relation of sensory perception and intelligence, from the time of Binet on. He considered the lower mentalities equal on the simple and sensory capacities, inferior only on the higher. Others (Wallin) find them inferior in all. The weights is the tests around which much of this discussion centers; e.g. Wallin[1] thinks weight perception depends on both kinaesthetic and intellectual factors, Terman that there is no correlation between weight perception and intelligence. The test is at a level where there might well be a concomitant amentia involved with the psychosis in any adult to whom it was given, but the possibility of this is hardly sufficient to overbalance the great amount of evidence that the psychoses we are considering have a greater effect on the sensory processes than on the intelligence.

(1) Wallin, J. E. W. "The Measurement of Mental Traits in Normal and Epileptic School Children." Miami University Bulletin, 1923, Vol. xxi: 8 ff.

Environmental Conditions.

Ability to pass many of the tests is wholly dependent on the environment of the subject, his relations to the prevailing culture, family, school, occupational situation, etc. Some of these, like the perception tests are so low in the scale that failure would seem to involve mental deficiency rather than psychosis in adults. In this class, are the objects (3-2), pennies (4-3), coins (4-3 and 6-5), right and left (6-1), picture enumeration (3-3), fingers (7-1), bow-knot (7-4). Others that are also dependent on environmental factors, days of week (7 A-1), months (9 A-1), dictation (9 A-2), stamps (A-2), reading and report (10-4), president and king (14-3) and problems of fact (14-4) are discussed under other classifications. Picture description and interpretation (7-2 and 12-7) also might be added here. The environmental influence is of course impossible to estimate psychometrically and would require clinical testimony for adequate evaluation.

Reasoning.

There are several distinct types of test in the Stanford scale involving reasoning. Some of these, that might also be referred to speed or comprehension or imagery categories, have been discussed. Two classes remain as requiring chiefly ability to reason, the distinctly mathematical tests, and the similarities and differences. The arithmetical results do not seem as indicative as other observers have found them, of schizophrenic ability to handle definite and concrete problems, when instructions are completely given, nor of paretic loss of reasoning ability[1]. The paretic figures are on the success side, the schizophrenic on the failure; none of the figures are large, the largest being the schizophrenic 6% of failure below age at 14. The reversed clock (14-6), also mathematical in nature, shows still more failure for the schizophrenic and the same small success; the record is better for the enclosed boxes (16-4), but the paretic is better still. Dearborn[2] includes the last named among the importantly indicative tests. None of the theories advanced seem to account for this relationship, whether the speed or the reasoning factors of the tests are chiefly considered.

Babcock[3], in her study of dementia praecox, suggests that the

(1) Altman, C. and Shakow, D. "Comparison of Schizophrenic, Normal and Delinquent Subjects." Journal of Educational Psychology, 1937, Vol. xxviii: 519-520.
      Hunt, J. McV. "Psychological Loss in Paretics and Schizophrenics." American Journal of Psychology, 1935, Vol. xlvii: 458-463.
      Wentworth, M. M. "Two Hundred Cases of Dementia Praecox, Tested by the Stanford Revision." Journal of Abnormal Psychology, 1923, Vol. xviii: 378-388.
      (2) Dearborn, G. V. N. "Intellectual Regression and Progression." American Journal of Psychiatry, 1926-7, Vol. vi: 725-741.
      (3) Babcock, Harriet. Dementia Praecox. Lancaster, Pa., Science Press, 1933.

schizophrenics can respond to data that they can perceive and understand; this might imply that the difficulty lies in concentration and comprehension rather than in inability to reason out the answers.

The result is more interesting and significant in the epileptic group. Success doubles failure in the arithmetic, thus suggesting better reasoning than memory (vide supra, p.33) ability, an opinion often held concerning the effects of this disorder. The reversed clock at 14 shows a still larger success figure, and the boxes, at 16, yields 9% success above age, with no failure below; i.e. there is a steady improvement in mathematical reasoning from the lower to the higher level tests.

In the similarities tests (8-4 and 12-8) the trend is decidedly to failure, in the differences (7-5 and 16-3), more to success. Also it can be noted that the success in the abstract differences is greater than in the concrete, a fact (like the fables results) somewhat contradictory to the assertions often made that the epileptic is less able to deal with abstract concepts than with concrete. The president and king test, though perhaps of limited usefulness now, when the course of modern history is considered, is suggestive in its results of the contact with the concerns of every-day life in the paretic and the usual loss of this contact in the schizophrenic.

Verbal Responses.

The significant feature of the vocabulary tests is the large percentage passed by the paretics above mental age, the only type of test in which this is found consistently true in the study. This is markedly different from the epileptic results, which show only slight variation from the mental age, and that little fairly equally divided between success and failure. The schizophrenic results lie between the other two in successes, and, like the paretic, show almost no failure. The largest percentages were the success above age at the 14-year level (50 words out of the list of 100). A very similar relationship appears between the groups in the special definitions tests at 12 years, the abstract words. The lower level definitions, adapted only to children, show little variation, tending slightly to failure.

The result is very different in the other linguistic tests, those that deal with the use of words rather than their recognition. Atwell and Wells[1] have brought out the fact that these are two functions of vocabulary tests that have not always been fully distinguished. They found a wide discrepancy between the scores on what they term precision tests and those of ordinary vocabulary. The trends here on this type of test are to failure below age in all three groups, the paretic much the largest, with almost no success above age in the paretic and praecox groups and little in the epileptic.

Table 6 assembles these results, which are especially noteworthy in several respects:

(1) Atwell, C. R. and Wells, F. L. "Wide Range Multiple Choice Vocabulary Tests." Journal of Applied Psychology, 1937, Vol. v: 550-555.

1. They indicate a decided difference between the organic and the functional group on the one hand, and the epileptic on the other.

2. They appear as a factor that adequately accounts for the slight superiority of the general paretics over the epileptics in the I.Q. tabulation, since the latter seem to have shown rather better records in other tests.

3. They furnish the data to be used in the application of the suggested numerical means of estimating deterioration, the third type of deterioration study to be next discussed.

Table 6.

Verbal Tests.

Vocabulary

		% passed above age			% failed below age		
Tests		Par.	Epil.	Schiz.	Par.	Epil.	Schiz.
8-6	20 words	.5%	.5%		1.5%	3 %	
10-1	30 "	7 %	3 %	4 %	.5%	1 %	.5%
12-1	40 "	11 %	1 %	5 %	1 %	2 %	1 %
14-1	50 "	16 %	5 %	12 %	.5%	2 %	
16-1	65 "	7 %	2 %	1.5%		.5%	
18-1	75 "	5 %	2 %	3 %			

Definitions

	% passed above age			% failed below age		
Tests	Par.	Epil.	Schiz.	Par.	Epil.	Schiz.
5-4 simple					1 %	
8-5 sup. to use	5 %	2 %	1 %	2 %	3 %	1 %
12-2 abstract	10.5%	4 %	6 %	.5%	2 %	2.5%

Other linguistic tests

	% passed above age			% failed below age		
Tests	Par.	Epil.	Schiz.	Par.	Epil.	Schiz.
9-5 3 words in sent.		1.5%	.5%	10 %	7 %	14 %
9-6 rhymes		1 %	.5%	22 %	10 %	13 %
10-6 60 words		3 %	1.5%	3 %	4 %	4 %
12-4 diss. sent.	1.5%	2 %		7 %	2 %	5 %

Patterns of Response.

Some writers have suggested as a result of their research, that there are very definite patterns of response in psychotics differing both quantitatively and qualitatively from those of normals. Piotrowski[1] is one who has emphasized this selective effect of mental disorder; he considers that much can be done for its understanding by a comparison of profiles made from a sufficient sampling of patients' responses, and by deriving from them. keys that can be generally applied in the study of psychotic effects. The previously cited work of Malamud and Palmer[2] also develops definite patterns of scatter, as indicative of deterioration. On the basis of their analysis, they are convinced of the utility of these patterns, both as supplementary diagnostic aids, and as a means of insight into the qualitative nature of deterioration; they consider that their study shows the value of psychometry in furnishing the data for both quantitative and qualitative changes in underlying psychic function.

In this study, the findings of the detailed analysis are not formed into such definite patterns as these writers have suggested, but the indications derived from them may be summarized into the following statements:

1. The general effect of mental disorder on intelligence is greatest in the organic psychoses.

2. Memory deteriorates more than intelligence and most in the

(1) Piotrowski, Z. A. "Objective Signs of Invalidity of Stanford-Binet Tests." Psychiatric Quarterly, 1937, Vol. xi: 623-636.
(2) Malamud, W. and Palmer, E. M. "Intellectual Deterioration in the Psychoses." Archives of Neurology and Psychiatry, 1938, Vol. xxxix: 68-81.

organic disorder.

3. Retardation in psychosis is most marked in the paretic subjects.

4. Imaginative processes are less affected than memory.

5. Evidence of disorientation is greatest in the schizophrenic group.

6. There is less contact with reality in the schizophrenic, more in the paretic group.

7. Abstract concepts are not more difficult than concrete for the epileptics.

8. Both types of judgment are affected in all three groups; practical judgment most in kinaesthetic test of the paretics; ideational most in the schizophrenics, least in the epileptics.

9. The trend to upper level success is more marked in the epileptics, particularly in the mathematical tests.

10. Most significant finding of the analysis - the superiority of the schizophrenic, and the still more marked superiority of the paretic on the vocabulary tests, while the epileptic shows little variation from the mental level.

Measures of Deterioration.

The third type of study devoted to deterioration is that which attempts to devise numerical measures. The main premises of the theories on which these are based are these - that the vocabulary measure is the best single measure of mental status that we have[1]; and that it is least affected in psychosis[2]. Babcock[3] was the first to capitalize these findings in her device of an "efficiency index"; this is the difference between the score obtained by a subject on her series of tests, and the norms for his intellectual level as determined by his vocabulary score. Her work in developing her index was done at Manhatton Hospital, with a group of paretics, and a normal control group, made up largely of the hospital personnel, and was checked by findings of psychiatrists as to correlation with the patients' clinical condition. She found the average efficiency index of the paretic group was 4.68 below that of the normals, and below that of the lowest normal individual, and that no paretic reached the average normal index. As a result of her research, she proposed her efficiency index as a valid numerical measure of deterioration, and considers it as of diagnostic and prognostic value. She later carried out a similar research[4] with schizophrenic subjects, with similar results.

(1) Terman, Lewis M. "The Vocabulary Test as a Measure of Intelligence." Journal of Educational Psychology, 1918, Vol. ix: 452-466.
    O'Connor, Johnson. Psychometrics. Harvard University Press, 1934. Pp xxiv + 292.
(2) Wells, F. L. and Kelley, C. M. "Intelligence and Psychosis." American Journal of Insanity, 1920, Vol. ixxvii: 17-45.
    Dearborn, G. V. N. "Intellectual Regression and Progression." American Journal of Psychiatry, 1926-7, Vol. vii: 725-741.
(3) Babcock, Harriet. "An Experiment in the Measurement of Mental Deterioration." Archives of Psychology, 1930, 117, pp 105.
(4) Babcock, Harriet. Dementia Praecox. A Psychological Study. Lancaster, Pa. Science Press, 1933.

The tests used by Babcock were first the Terman vocabulary, and then her special series of 24 tests, not original, but adapted from many sources, emphasizing speed and memory, and with very exact methods of administration, sometimes differing from the original directions of the authors of the tests. The method has been used by many other investigators, some following closely her procedure, and some differing in detail and in interpretation.

Simmins[5], in a London hospital, and Harbinson[6], recently following her procedure, conducted similar experiments based on comparison of Terman vocabulary results with a series of "non-verbal, visual-perception tests consisting of simple diagrams"; this was first tried out on a control group with great range of ability, to obtain norms. The results were similar to Babcock's, but Simmins was especially interested in interpreting them in terms of the Spearman bi-factor theory of g (general intelligence) and s (special ability). She later repeated the experiment in two other hospitals with a superior type of patient, and found similar but less striking results.

Of the writers who have used the Stanford tests in such studies, some have contrasted the vocabulary scores with the mental age, and some with the scores of the other than linguistic tests of the scale. The Stanford has sometimes been criticized for its domination by linguistic elements, a

(5) Simmins, Constance. "Studies in Experimental Psychiatry. Deterioration in "G" in Psychotic Patients." Journal of Mental Science, 1933, Vol. lxxix: 704-734.
(6) Harbinson, M. R. "An Investigation of Deterioration of General Intelligence in "G" in Psychotic Patients." British Journal of Psychology. Medical Section, 1936, Vol. vi: 146-148.

characteristic, which, whether an advantage or a detriment, certainly makes more striking the psychotic discrepancies that have been found between mental age and vocabulary.

Wittman[7] has used the procedure in Illinois, Jastak[8] in Delaware, Schwarz[9] in New York, with similar results. Davidson[10], at Toronto, is another who adopts the vocabulary standard of pre-psychotic intelligence, in a study of schizophrenic performance on the Stanford, and takes the algebraic difference between the total Stanford score and the vocabulary score, in months of mental age, as the discrepancy measure. He finds close correspondence in the normal controls and marked discrepancies in the schizophrenics.

There seems to be general agreement as to results by all who have tried the method; all find a noticeable discrepancy in the two types of test in the definitely psychotic, not in the normal. There is, however, some difference in interpretation. Altman and Shakow[11] find a similar relation to Babcock's, but doubt if either their discrepancy score or her efficiency index can be definitely attributed to deterioration. They compute the standard deviation from the mean of their group vocabulary scores, and from the

(7)   Wittman, P. "The Babcock Deterioration Test in State Hospital Practice." Journal of Abnormal and Social Psychology, 1933, Vol. xxvii: 70-84.
(8)   Jastak, J. "Psychometric Patterns of State Hospital Patients." Delaware State Medical Journal, 1937, Vol. ix: 7-10. Summary in Psychological Abstracts, 1937, Vol. xi, No. 4152.
(9)   Schwarz, R. "Measurement of Mental Deterioration in Dementia Praecox." American Journal of Psychiatry, 1932,3, Vol. xii: 555-562.
(10) Davidson, Marsh. "A Study of Schizophrenic Performance on the Stanford-Binet Scale." British Journal of Psychology, Medical Section, 1937, Vol. xvii: 93-97.
(11) Altman, C. and Shakow, D. "A Comparison of Schizophrenic, Normal and Delinquent Subjects." Journal of Educational Psychology, 1937, Vol. xxviii: 519-529.

mean of the scores on the other tests of the scale, and the algebraic difference between the σ-scores is their discrepancy score; they then compute the correlation of these scores with many criteria - length of hospitalization, clinical grading by psychiatrists on a five-point scale, educational level, chronological age, and find correlation close to zero. They find a slight but not significant correlation with the complete Stanford mental age in the expected direction. They agree that high discrepancy scores are a distinguishing feature of schizophrenic patients, but suggest that it shows a measure of "thinking disturbance" in the disorder that may or may not be related to deterioration. They do not deal with paretics, on which group Babcock's original work was done.

In this study, with its data drawn from the routine testing of years, there appears much evidence of the facts on which these deterioration theories are based. In two of our groups, there appears a decided discrepancy between the mental ages of the subjects and their vocabulary scores. In the epileptic list, there is no definite trend to either superiority or inferiority of vocabulary. Simmins, in her English study, just cited, dealt with many different forms of mental disorder, and found similar relationships to ours. She was inclined to account for the difference in the group results by postulating a distinct verbal disability as characteristic of epilepsy. The present writer, while finding evidence in agreement with hers, is inclined to suggest a different interpretation, namely, that epilepsy conforms to the normal rather than the psychotic pattern, and that the subjects with the low mental ratings, were mentally sub-normal rather than deteriorated. Whatever the explanation, the results of our study are certainly suggestive

of a difference in effect on the intelligence of epilepsy and general paresis, and of a similar difference though less in degree between the epileptic and the schizophrenic.

Re-tests.

The re-test method of estimating deterioration through comparison of the results in a repetition or a series of tests at varying intervals, has been used in many hospital studies. There have been many points of variance in these: the attempt is often made to limit other factors of variability than the one to be studied, by controlling mental or chronological age of the subjects; the number of the cases may be large, or it may be small enough for clinical consideration to be added to the statistical; the testing is usually done for the purpose of the study and by the experimenter or under his direction; the tests are generally standard intelligence tests or adaptations and combinations of them, but occasionally are devised solely for the special study. Examples of these are:

1. Some epileptic studies, which found fluctuations both up and down, and therefore little evidence of deterioration, were those of Fetterman and Barnes'[1] dispensary study at Cleveland, Sullivan and Gahagan's[2] children's hospital study at Los Angeles, Wallin's[3] colony study at Skilman, and that of Fox[4] at Lingfield, England. Dawson and Conn[5] at Glasgow used the healthy siblings of their patients as a control group and did

(1) Fetterman, J. and Barnes, M. "Serial Studies of Patients with Epilepsy." Archives of Neurology and Psychiatry, 1934, Vol. xxxii: 768-867.
(2) Sullivan, E. G. and Gahagan, L. "On Intelligence of Epileptic Children." Genetic Psychology Monographs, 1935, Vol. xvii: 309-376.
(3) Wallin, J. E. W. "The Measurement of Mental Traits in Normal and Epileptic School Children." Miami University Bulletin, 1923, Vol. xxi: 8 ff.
(4) Fox, J. Tylor. "Mental Tests for Epileptic Children." British Journal of Psychology, Medical Section, 1924, Vol. iv: 235 ff.
(5) Dawson, S. and Conn, J. C. M. "The Intelligence of Epileptic Children." Archives Diseases of Childhood, 1929, Vol. iv: 142-151.

find deterioration with a series of retests with Binet-Burt tests.

2. Studies in schizophrenia. Trapp and James[6] at the Boston State Hospital used tests and retests by the Stanford to differentiate deteriorating effects of the four types of the disorder. They find the paranoids least affected, the hebephrenics most.

Davidson[7] at Toronto used retests by the Stanford as a check-up of his discrepancy score results and considered deterioration proved.

3. Retest studies in paresis. Babcock[8] added retests to her clinical checks in her original study in developing her efficiency index. Her subjects were paretics.

Epstein and Solomon[9], in an article now in press, deal with the Stanford records of 75 of the Boston Psychopathic cases that form part of the case-material of this study. They consider changes in I.Q. on retests, in different types of the disease, under different forms of therapy, at different chronological ages, and in comparison with clinical findings; they find both gains and losses. Retests are most valuable in paresis as used here in connection with clinical findings, and as a study of the mental effects of the therapy rather than of the course of the psychosis. The authors use psychometric determinants as a means of obtaining an estimate of mental status uninfluenced by the personal equation of the clinical evaluator.

(6) Trapp, C. E. and James, E. B. "Comparative Intelligence Ratings in the Four Types of Dementia Praecox." Journal of Nervous and Mental Diseases, 1937, Vol. lxxxvi: 399-404.
(7) Davidson, Marsh. "A Study of Schizophrenic Performance on the Stanford-Binet Scale." British Journal of Psychology. Medical Section, 1937, Vol. xvii: 93-97.
(8) Babcock, Harriet. "Measurement of Deterioration." Archives of Psychology, 1930, Vol. xviii, No. 117: pp 105.
(9) Epstein, S. H. and Solomon, H.C. "The Effect of Treatment on the Mental Level of Patients with General Paresis." In press.

They compare clinical and psychometric results with some interesting find-
ings: - that an I.Q. too low for the former educational and occupational
level denotes previous deterioration and makes recovery less likely; that
there is a slight difference in favor of fever over chemo-therapy; that low
and high original I.Q.'s are less likely to show clinical improvement than
those in the middle range; that spinal fluid changes do not conform to
psychometric results, a corroboration of clinical experience; that the eu-
phoric type stands the best chance of improvement; study of tests several
times repeated shows that improvement comes soon after treatment if at all.
They testify to the validity of numerical psychometric methods in study of
the effects of therapy.

No attempt was made by the writer to obtain retest scores in the
schizophrenic cases; too small a number would have been available because
of the usual short term of residence for observation and diagnosis only, be-
fore going on to other mental hospitals. As to treatment of this disorder,
the two very modern and still experimental forms of therapy, insulin shock
and metrazol (cardiazol) have come into use too recently for mental effects
to be reflected in any of our test responses. Their intellectual influence
may prove to be measurable psychometrically and it may not. Both methods
of therapy seem to depend somewhat on psychological factors. According to
Schilder[10], metrazol is "an organic treatment reflected in psychological
attitudes"; according to Winkelman[11], it is based on a biological antag-
onism between schizophrenia and epilepsy (though this is a moot point by

(10) Schilder, Paul. "Psychology of Metrazol Treatment of Schizo-
phrenics." Journal of Nervous and Mental Diseases, Feb. 1939: 133-144.
     (11) Winkelman, N. "Metrazol Treatment in Schizophrenia." American
Journal of Psychiatry, Sept. 1938, Vol. xxv: 303-315.

no means generally agreed upon). It may be of interest in future work to
see if test responses, after remission or cure, show an organic, a function-
al or a normal pattern of scatter.

Deterioration and Duration.

In the case studies where the statistical correlation technique
has been used to estimate deterioration, the discrepancy scores between pre-
sent efficiency and estimated pre-psychotic intelligence usually furnish one
variable; the other, duration, must either depend on case histories and
clinical estimates, or on length of hospitalization, the latter with quite
recognized limitations for significant statistical use.

This study is handicapped in the obtaining of both necessary var-
iables. Length of hospitalization is of course meaningless, all terms of
residence are so short. In the case of two of the three groups, the onset
of the disease is so insidious that no definite duration can be assigned.
In the epileptic cases, however, the case histories did usually give a def-
inite statement of the time of the first convulsion, and this was used as
the basis for the computation of duration. Discrepancy scores or efficiency
indices have not been computed for each individual; merely group trends have
been investigated as to the difference between verbal efficiency and mental
age. Therefore, there is only the I.Q. at admission to supply the other var-
iable. A scatter diagram using the two variables of I.Q. and duration is
submitted in Figure 4, with full realization of its inadequacy as an index
of deterioration, but in the belief that it may be of interest as manifest-
ing a group trend. If there should prove to be a high negative correlation
between these two variables in a psychotic group, it might indicate that the
longer the disease had lasted the lower the I.Q., and this would be a sug-
gestion if not a proof, of a tendency toward deterioration, and of the time
element as an important factor in it. Malamud and Palmer[1] find that in

(1) See bottom of next page.

both their organic and schizophrenic groups, the group relationship of de-
terioration to duration approximates zero. They find great differences in
this relationship in individuals and in the various types of some disorders.
The correlation computed from the scattergraph of this study in Figure 4 is
found to be -.21, a slight negative correlation below the level of signifi-
cance. Great individual differences also appear here.

Wentworth[2] found no correlation between deterioration and du-
ration in the Stanford responses of her 200 schizophrenics at Taunton. Her
age range was from 10 to 16, and mental age from 2 to 17 with median at
9 years, 5 months. She comments on the much lower range of mental ages in
her group than in that of Wells and Kelley[3] at McLean, but considers the
latter a much more selected group, of originally higher mentality. Hers is
also much lower in range than the schizophrenics of this study, of which the
median is 12 years, 4 months. Her group ran somewhat lower in chronological
age but there could hardly have been enough schizophrenic subjects between
the ages of 10 and 16 to account for the three years' discrepancy in median
mental age. Since both Taunton and the Boston Psychopathic are state in-
stitutions, there is not likely to be much difference in the average educa-
tional and occupational level of the inmates. The discrepancy may be another
bit of evidence of the difference between a mental "clearing-house", and the
other state hospitals, and between early and late cases, and so suggest the
deterioration which her correlations do not show.

(1) Malamud, W. and Palmer, E. M. "Intellectual Deterioration in the
Psychoses." Archives of Neurology and Psychiatry, 1938, Vol. xxxix: 283-293.
(2) Wentworth, M. M. "Two Hundred Cases of Dementia Praecox Tested by
the Stanford Revision." Journal of Abnormal Psychology, 1923, Vol. xviii:
378-384.
(3) Wells, F. L. and Kelley, C. M. "Intelligence and Psychosis." Amer-
ican Journal of Insanity, 1920, Vol. Lxxvii: pp 18-19.

Epileptic Cases

Diagram Showing Correlation between

I.Q. and Duration

$r = -.21$

Duration
Years

50

40
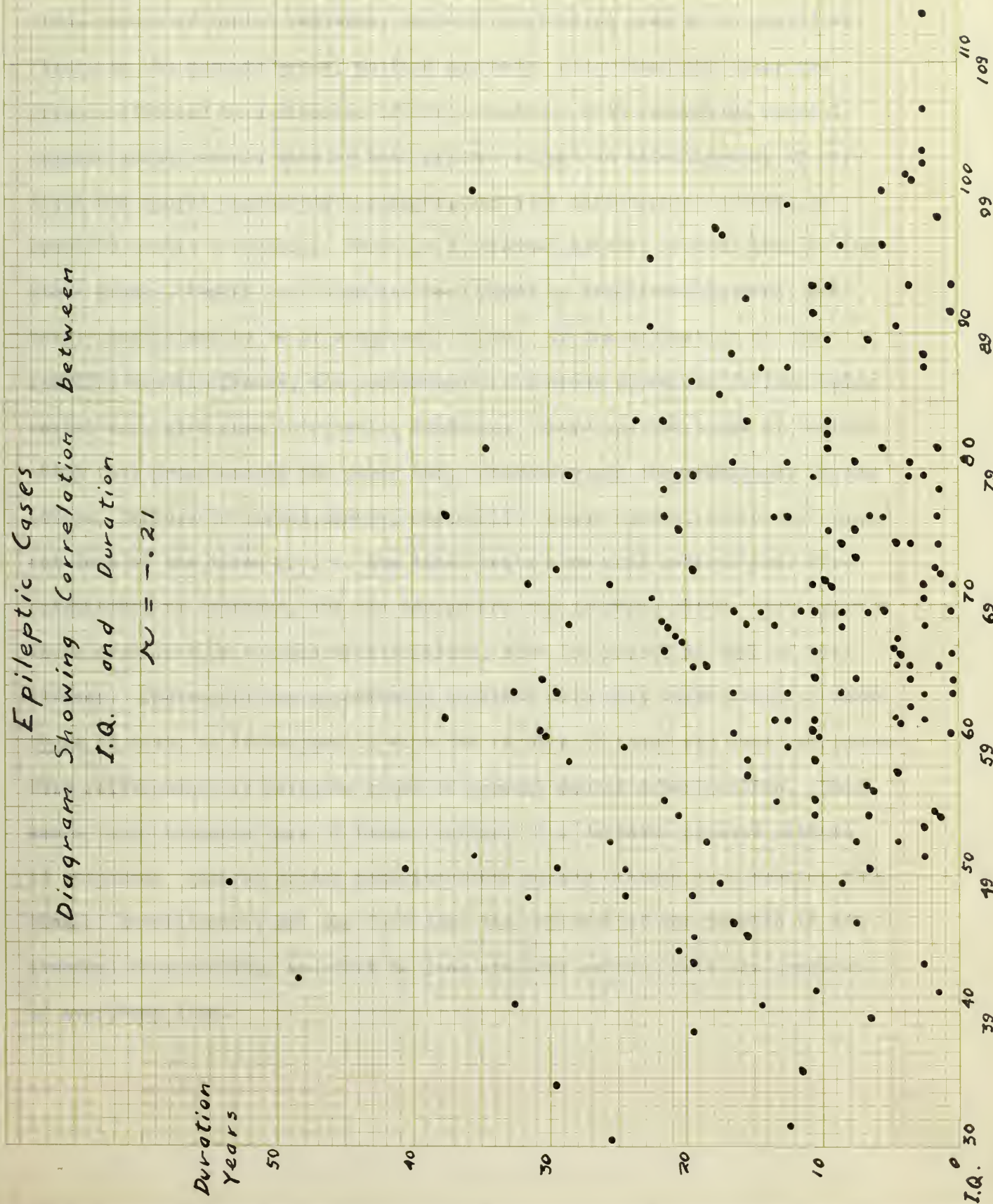
30

20

10

0

39 40 49 50 59 60 69 70 79 80 89 90 99 100 109 110   I.Q.

Conclusions.

As a result of this investigation of the test responses of these three groups of mental patients, certain conclusions seem to be justified. First, in the paretic group, we find subjects, older than the other two groups, affected by a disorder of long standing, with recognized harmful organic consequences, showing both general effect on intelligence, of cortical and neural degenerative changes, and also differential effects on specific mental functions. There is a somewhat greater scatter than in the other groups, though less than has been found by some investigators, and hardly sufficient to be of diagnostic value. In the estimation of the specific mental effects, the percentages of success above and failure below mental age, give some interesting findings: there are two types of test in which this group excels the other two, vocabulary and comprehension; in the others, failure is marked; memory, especially recent memory, shows the greatest loss of the three groups, the timed tests show much retardation, disorientation is apparent, and the perception and judgment tests, particularly those dependent on a kinaesthetic factor, show the neural inroads of the disease. The vocabulary superiority combined with this inferiority in other types of test, is in conformity with the results of those who have considered this relationship as definite proof of general mental deterioration. There seems to be evidence here of three features of a definite paretic pattern of response: general mental deterioration; memory failure even greater than that of intelligence; and the fact that the interest of the paretic is not divorced from reality, and that he does not lose contact with the concerns of every-day life.

The implications are less clear in the case of the schizophrenic group. The nature of the disorder, with no organic lesions, and with effects determined more by attitudes and affective factors, makes it a matter of personality and adjustment more than of intelligence; probably the reactions involved are more distinctly individual and less amenable to classification than those of the paretic. Three conditions are often found in the test responses of this group - lack of interest in reality, failure in the performance tests, and some success in the stereotyped, laboratory type of test. We find the first two manifest in greater failure in absurdities tests, fables, and ball and field, but the evidence for the third is slighter and more negative than positive; there is not much success in digits and arithmetic, but there is rather less failure than in the paretics. The vocabulary involves old learning and practiced responses, and shows superiority to mental age, but less in degree than in the paretics. Compared in this group with the results in other types of test, the discrepancy is definitely present, whether considered as representing deterioration or thinking disturbance. Perhaps the most definite statement that should be made here is that the chief characteristic of the schizophrenic response pattern is a loss of the directional control of thought.

There are some rather striking features of the epileptic test results; these lie more in general trends than in responses to specific tests. One of these trends is to more failure in the lower level than in the other two groups, and more success in the upper; another is to greater success in dealing with the abstract concepts of the upper scale than with similar tests of a concrete nature in the lower. There is much memory failure but less

than in the paretics, and more success in reasoning; there is failure of judgment of both types, but less than in the schizophrenics. The variability as shown by the scatter is great, but slightly less than in the other groups. Finally, there is no discrepancy between vocabulary scores and mental age, and therefore none of the evidence of deterioration sought by the efficiency index type of numerical measure. These trends have been considered by the writer in a study[1] previously published with collaborators, of these same epileptic cases; and were there evaluated in connection with two other recognized facts: that institutional cases of epilepsy usually include a large percentage of the feebleminded[2]; and that students of adult learning[3] believe that deterioration begins earliest, and is greatest in extent in the lower mentalities, and is later of incidence and slower of effect on those of a higher level. The upper quartile of the Boston cases might well represent the effect of epilepsy on the normal mind, the lower the complication with a concomitant amentia that preceded the epilepsy. The suggestion made was that the effect of the epileptic convulsion on the lower mentalities might make for general mental failure and increased deficiency, but might find more resistance in the normal mind in the chief interests and abilities of the subject; and therefore that the failure might be confined more to the functions in which the subject was least efficient. This would account for both the upper level efficiency and the variability.

(1) Collins, A. L. Atwell, C. R. and Moore, M. "Stanford-Binet Response Patterns in Epileptics." American Journal of Orthopsychiatry, 1938, Vol. viii: p 62.

(2) Stein, Calvert. "Hereditary Factors in Epilepsy." American Journal of Psychiatry, 1933, Vol. xxix: p 1009.

(3) Freeman, Frank S. Individual Differences. New York. Henry Holt & Company, 1934, pp 271 ff.

This research, then, is offered as showing the possibilities of psychometry in the study of the psychic effects of mental disorders and as furnishing evidence in the groups studied of three different reaction patterns, an organic, a functional, and a non-psychotic pattern of response.

Digest.

The application of psychometric methods to problems of psycho-pathology furnishes the material of this research which is concerned with the effects of psychoses on intelligence. It takes the form of an analysis of the Stanford-Binet test responses of 688 patients at the Boston Psychopathic Hospital, representing three radically different types of mental disorder. It differs from other studies in the field in that the subjects were not selected, and the tests were not given for the purpose of an experiment; the data used were assembled from the hospital files, and represent the routine testing of many years, and the responses of unselected samplings of the three psychotic groups. The subjects include 249 cases of the recognized organic disorder, general paresis, 210 cases of schizophrenia, very generally classified as functional, and 229 patients with epilepsy, a disorder of obscure origin, with effects always physical, often mental, and sometimes psychotic. The test scores of these subjects were tabulated and arranged for statistical use in the investigation of evidence of deterioration in intelligence, and for comparison with the results of other studies in the field. The scores are used here as representing, not the innate intelligence of the subject, but the mental state at the time of testing, and therefore as giving a valid picture of the effect of the psychosis on his intellectual capacity.

Considering the relative general status of the three groups: - the paretics, whose disorder is the mental resultant of an organic disease of long standing, average about 12 years older than the other two groups; the I.Q.'s of this group and of the epileptics, whose disorder is often found in institutional cases, to be complicated by an antecedent amentia, average

about 70; this is 8 points lower than the schizophrenics, who, in a diagnostic hospital, are usually early cases. The I.Q. ogive curve of the last named group corresponds very closely with that of the general adult inmates of the hospital, in general shape, median and average.

The methods used in the estimation of deterioration include first an investigation of the amount of scatter, (irregularity of test performance). The procedure used is simpler than that of many workers in the field, and consists merely in counting for each subject, the number of years (not test levels) from the basal where all tests were passed to the year where all were failed. There was much scatter in all, the paretics showing the greatest amount, the epileptics least, but with the differences between them so slight as not to be statistically significant. Therefore the scatter investigation furnishes insufficient evidence for diagnostic value, but confirms the usual view of greater scatter in organic psychoses.

The second method of examination used, is a detailed statistical examination of all the sub-test responses. In group comparisons of this sort, it is usually considered necessary for statistical reliability to control mental age. This is done here, not by selecting matched subjects, but by considering the scores in relation to the mental age. The method adopted is a computation of the percentages in each group of the total number of patients that passed each test above or failed it below mental age. These percentages are classified under the different types of mental functioning to which each test seems to apply. The result of many studies based on Stanford and other tests has led to the belief that there is a marked differential effect of psychoses on various mental functions, and that these

effects are evidenced in definite patterns of response and of scatter; also that certain of these patterns may be found to be characteristic of different forms of psychosis, and of psychotic as compared to normal mentality. In this study, there appears evidence of many of the effects which might form such patterns, and suggest both qualitative and quantitative changes in the underlying psychic functioning of the disorder. Among these findings are:

Confirmatory evidence of the usual belief that the effect of mental disorder on intelligence is greatest in the organic psychoses.

Memory shows much more deterioration than intelligence and most of all in paresis. Remote memory is less affected than recent.

Retardation, which is studied by a consideration of the tests with a time limit, is evident in all, but most marked in the paretics.

Imaginative processes are much less affected than memory, and show the least failure in the epileptics.

The effect of disorientation is greatest in the schizophrenic group, who show a great loss of contact with reality, not so evident in the other two groups; the paretics show little of this and much more concern with the ordinary affairs of life.

The schizophrenic reactions seem to testify more to loss of the directional control of thought than deterioration in intelligence.

Abstract concepts, contrary to many theories held in the past, seem less difficult for epileptics than do concrete concepts.

Both practical and ideational judgment are affected in all three groups. The kinaesthetic failure of the paretic in the estimation of weights, a very large figure, shows the neural damage of the disorder. Ideational

judgment shows most failure in the schizophrenics, least in the epileptics.

There is a marked trend in the epileptic group from the largest failure figures in the lower part of the scale, to the most success at the upper level. This is particularly observed in the arithmetical and the reasoning type of test.

The most significant finding of the analysis is the great success above age of the paretics in the vocabulary tests, and a similar trend, though less in degree in the schizophrenics, while the epileptics show almost no variation in vocabulary scores from the mental age level.

This last finding, which corroborates that of many previous investigations, leads to the consideration of a third method of studying deterioration, the attempts to devise numerical measures: in certain of these, the vocabulary, usually showing no lowering of level, is taken as the measure of pre-psychotic intelligence, and various methods of measuring the discrepancy between this and other types of test have been devised. The method has been used by many experimenters, and results have usually agreed, though details of the testing methods and interpretations have differed. Such a discrepancy has been quite generally interpreted as an adequate measure of deterioration in intelligence in the organic psychoses, and the data of this study furnish striking evidence confirmatory of this view, in the paretic group.

There is more difference of opinion as to the significance of discrepancy scores in schizophrenia, and more objection to their interpretation as evidence of deterioration. In this study, the praecox result is similar though less in degree to that of the paretic, and shows a definite psychotic pattern, whether interpreted as deterioration or as thinking disturbance of

some kind. As to the epileptic result, the writer is inclined to interpret it as conforming more to a normal than to a psychotic pattern, and as indicating in the lower mentalities of the group, sub-normality rather than deterioration.

Retests have been used to measure deterioration in many studies, usually as a check-up of results found by other methods. Epileptic studies using serial tests have varied much in results, some finding much, some little or no deterioration. Schizophrenic study by retests has discovered much variation in the different types of the disease. There were insufficient retest scores available for the application of this method here to these two groups. A very recent study of the retests of some of the paretic subjects of this list by members of the neuro-syphilitic staff of the Boston hospital is now in press; it produces some very interesting findings as to the mental effects of the treatment of the disease. The method seems to be very valuable, especially in general paresis, as a study of the effects of therapy rather than of deterioration. The two new forms of therapy in schizophrenia, insulin shock and metrazol (cardiozol), though having acknowledged psychological factors, are too new yet for any psychometric data to be available.

Estimation of deterioration by statistical correlation was impossible in two of the groups because of lack of accurate data as to duration. In the epileptic group, the time of onset was obtained from case histories, and the duration figures were used with the I.Q.'s of the group as the other variable. The result is a low negative correlation, below the level of significance.

The chief contribution of this study seems to lie in the analysis of the sub-test scores and the rather definite patterns of response which they disclose. These might be summarized as a pattern of deterioration and memory failure in the paretic, of apathy and thinking disturbance in the schizophrenic, and as a non-psychotic pattern in the epileptic.

Bibliography.

Abadie, Jean. "L'Epilepsie Psychique." Revue Neurologique, 1932, Vol. 1 (Vol. 57): 1201-2116.

Achilles, E. M. "Experimental Studies in Recall and Recognition." Archives of Psychology, 1920, Vol. lxiv: No. 44: Pp 82.

Altman, Charlotte and Shakow, David. "A Comparison of the Performance of Matched Groups of Schizophrenic Patients, Normal Subjects, and Delinquent Subjects on Some Aspects of the Stanford-Binet." Journal of Educational Psychology, 1937, Vol. xxviii: 519-529.

Atwell, C. R. and Wells, F. L. "Wide Range Multiple Choice Vocabulary Tests." Journal of Applied Psychology, 1937, Vol. v: 550-555.

Babcock, Harriet. "An Experiment in the Measurement of Mental Deterioration." Archives of Psychology, 1930, Vol. xviii: No. 117: Pp 105.

Babcock, Harriet. Dementia Praecox. A Psychological Study. Lancaster, Pa. Science Press, 1933. Pp 167.

Babcock, Harriet. "Intelligence Testing in Psychopathology." Journal of Applied Psychology, 1931, Vol. xv: 584-589.

Binet, A. and Simon, Th. The Intelligence of the Feebleminded. (trans. by E. S. Kite from L'Annee Psychologique, 1909) Baltimore, Williams and Wilkins Company, 1916. Pp 327.

Bolles, Marjorie and Goldstein, Kurt. "A Study of the Impairment of Abstract Behavior." Psychiatric Quarterly, 1938, Vol. xii: 42-65.

Bridge, Edward M. "Mental State of the Epileptic Patient." Archives of Neurology and Psychiatry, 1934, Vol. xxxvii: 723-726.

Clark, L. Pierce. "A Psychological Interpretation of Essential Epilepsy." Brain, 1920, Vol. lxiii: 38 ff.

Collins, A. L., Atwell, C. R. and Moore, Merrill. "Stanford-Binet Response Patterns in Epileptics." American Journal of Orthopsychiatry, 1938, Vol. viii: 51-63.

Curtis, J. N. "Point Scale Examinations on the High-Grade Feebleminded and the Insane." Journal of Abnormal Psychology, 1918, Vol. xiii: 77-118.

Davidson, Marsh. "A Study of Schizophrenic Performance on the Stanford-Binet Scale." British Journal of Psychology. Medical Section, 1937, Vol. xvii: 93-97.

Dawson, S. and Conn, J. C. M. "The Intelligence of Epileptic Children." <u>Archives of Diseases of Childhood</u>, 1929, Vol. iv: 142-151.

Dearborn, G. V. N. "Intellectual Regression and Progression." <u>American Journal of Psychiatry</u>, 1926-7, Vol. vii: 725-741.

Doolittle, G. J. "The Epileptic Personality." <u>Psychiatric Quarterly</u>, 1932, Vol. vi: 89-95.

Dorcus, R. N. and Shaffer, G. W. <u>Text-Book of Abnormal Psychology</u>. Baltimore, Williams and Wilkins Company, 1934. Pp xiii + 389.

Epstein, S. H. and Solomon, H. C. "The Effect of Treatment on the Mental Level of Patients with General Paresis." <u>American Journal of Psychiatry</u>. In press.

Fetterman, James and Barnes, Margaret. "Serial Studies of Patients with Epilepsy." <u>Archives of Neurology and Psychiatry</u>, 1930, Vol. xxxii: 768-867.

Foster, J. C. "Significant Responses in Certain Mental Tests." <u>Journal of Applied Psychology</u>, 1920, Vol. iv: 142-154.

Fox, J. Tylor. "Mental Tests for Epileptic Children." <u>British Journal of Psychology. Medical Section</u>, 1924, Vol. iv: 235 ff.

Freeman, Frank S. <u>Individual Differences</u>. New York, Henry Holt and Company, 1934, Pp xi + 355.

Garrett, H. H. <u>Statistics in Psychology and Education</u>. 2nd edition. New York. Longmans, Green and Company, 1938. Pp xiii + 493.

Gatewood, L. C. "Experimental Study in Dementia Praecox." <u>Psychological Monographs</u>, 1909, Vol. xi, No. 45: 87 ff.

Gowers, W. R. <u>Epilepsy</u>. London, Churchill, 1881, Pp xxiv + 320.

Harbinson, M. R. "An Investigation of Deterioration of General Intelligence or "G" in Psychotic Patients." <u>British Journal of Psychology. Medical Section</u>, 1936, Vol. vi: 146-148.

Harris, A. J. and Shakow, David. "The Clinical Significance of Numerical Measures of Scatter in the Stanford-Binet." <u>Psychological Bulletin</u>, 1937, Vol. xxxiv, No. 3: 130-150.

Harris, A. J. and Shakow, David. "Scatter on the Stanford-Binet in Schizophrenic, Normal and Delinquent Adults." <u>Journal of Abnormal and Social Psychology</u>, 1938, Vol. xxxiii: 100-111.

Hart, B. and Spearman, C. "Mental Tests of Dementia." Journal of Abnormal Psychology, 1914, Vol. ix: 217-254.

Henderson, D. K. and Gillespie, R. S. Test-Book of Psychiatry. 4th edition. Oxford University Press, 1936, pp ix + 606.

Henry, George W. Essentials of Psychiatry. 2nd edition. Baltimore, Williams and Wilkins Company, 1931. Pp xiv + 304.

Hull, C. L. "The Formation and Retention of Associations Among the Insane." American Journal of Psychology, 1917, Vol. xxviii: 419-439.

Hunt, J. McV. "Psychological Experiments with Disordered Persons." Psychological Bulletin, 1936, Vol. xxxiii: 1-58.

Hunt, J. McV. "Psychological Loss in Paretics and Schizophrenics." American Journal of Psychology, 1935, Vol. xlvii: 458-463.

Jastak, J. "Psychometric Patterns of State Hospital Patients." Delaware State Medical Journal, 1937, Vol. ix: 7-10. Summary in Psychological Abstracts, 1937, No. 4152.

Jung, C. J. Studies in Word Association. (trans. by Eder). New York, Moffat Yard Company, 1919. Pp 575.

Kraepelin, E. "General Paresis." (trans. by Moore, J. M. from Psychiatrie). Nervous and Mental Disease Monograph Series, 1913, Vol. xiv: Pp 200.

Lennox, W. G. and Cobb, Stanley. "Epilepsy." Medicine, 1928, Vol. vii: 105-290.

Malamud, William and Palmer, Eleanor M. "Intellectual Deterioration in the Psychoses." Archives of Neurology and Psychiatry, 1938, Vol. xxxix: 68-81.

Mateer, F. "The Future of Clinical Psychology." Journal of Delinquency, 1921, Vol. vi: 283-293.

Mateer, F. The Unstable Child. New York, D. Appleton-Century Company, 1924, Pp xii + 471.

McFadden, J. H. "Differential Responses of Normal and Feeble-minded Subjects." Mental Measurement Monographs, 1931, Vol. vii: 85. (Cited by Harris and Shakow in Psychological Bulletin, 1937, Vol. xxxiv, No. 3: Pp 136.

Moss, F. A. and Hunt, Thelma. Foundations of Abnormal Psychology. New York, Prentice and Hall, 1932, Pp xii + 548.

O'Connor, Johnson. Psychometrics. Harvard University Press, 1934, Pp xxiv + 292.

Paskind, H. A. "Extra-Mural Patients with Epilepsy with Special Reference to Frequent Absence of Deterioration." Archives of Neurology and Psychiatry, 1932, Vol. xxv: 19-32.

Patterson, H. A. and Fonner, Delma. "Some Observations on the Intelligent Quotient in Epileptics." Psychiatric Quarterly, 1928, Vol ii: 542-8.

Piotrowski, Z. A. "Objective Signs of Invalidity of Stanford-Binet Tests." Psychiatric Quarterly, 1927, Vol. xi: 625-636.

Porteus, S. D. "Studies in Mental Deviation." Vineland New Jersey, Training School Publishing Department Research, 1922, Vol. xxiv: Pp xi + 276.

Pressey, S. L. "Distinctive Features in Psychological Test Measurements." Journal of Abnormal Psychology, 1917, Vol. xii: 130-139.

Pressey, S. L. and Cole, L. W. "Irregularity in a Psychological Examination as a Measure of Mental Deterioration." Journal of Abnormal Psychology, 1919, Vol. xiii: 285-294.

Rosanoff, A. J. Manual of Psychiatry. New York, John Wylie and Sons, Inc., 1920, Pp xv + 684.

Schilder, Paul. "Psychology of Metrazol Treatment of Schizophrenia." Journal of Nervous and Mental Disease, 1939, Vol. xxxxvi: Pp 133-144.

Schott, E. L. "Superior Intelligence in Patients with Nervous and Mental Illness." Journal of Abnormal and Social Psychology, 1931, Vol. xxvi: 94-101.

Schwarz, Rudolph. "Measurement of Mental Deterioration in Dementia Praecox." American Journal of Psychiatry, 1932-3, Vol. xii: 555-562.

Simmins, Constance. "Mental Incapacity; the Intelligence of Patients in Mental Hospitals." Character and Personality, 1935, Vol. iv, No. 1: 25-33.

Simmins, Constance. "Studies in Experimental Psychiatry. Deterioration in "G" in Psychotic Patients." Journal of Mental Science, 1935, Vol. lxxix: 704 ff.

Smith, W. A. "A Comparison of Some Mental and Physical Tests in Their Application to Epileptics and to Normal Subjects." British Journal of Psychology, 1904, Vol. 1: 240-266.

Squires, Paul C. Notes and Discussions. American Journal of Psychology, 1935, Vol. xlviii: 169-172.

Stein, Calvert. "Hereditary Factors in Epilepsy." American Journal of Psychiatry, 1933, Vol. xxix: 989-1037.

Strecker, Edward and Ebaugh, Franklin G. Practical Clinical Psychiatry for Students and Practitioners. Philadelphia, Blakiston's Sons and Co., Inc. Pp xiii + 553.

Sullivan, Ellen B. and Gahagan, Lawrence. "On Intelligence of Epileptic Children." Genetic Psychology Monographs, 1935, Vol. xvii: 309-376.

Talbot, F. B. Treatment of Epilepsy. Boston, MacMillan Company, 1930, Pp xiii + 308.

Terman, Lewis M. The Measurement of Intelligence. Boston, Houghton Mifflin Company, 1916, Pp xviii + 362. Riverside Text-Books in Education.

Terman, Lewis M. "The Vocabulary Test as a Measure of Intelligence." Journal of Educational Psychology, 1918, Vol. ix: 452-466.

Terman, L. M. and Merrill, Maude. Measuring Intelligence. Boston, Houghton Mifflin Company, 1938, Pp xiv + 460. Riverside Text-Books in Education.

Trapp, Carl E. and James, Edith B. "Comparative Intelligence Ratings in Four Types of Dementia Praecox." Journal of Nervous and Mental Diseases, 1937, Vol. lxxxvi: 399-404.

Wallin, J. E. W. "Intelligence Irregularity as Measured by Scattering in the Binet Scale." Journal of Educational Psychology, 1922, Vol. xiii: 140-151.

Wallin, J. E. W. "The Measurement of Mental Traits in Normal and Epileptic School Children." Miami University Bulletin, 1923, Vol. xxi: 8 ff.

Wells, F. Lyman. Mental Tests in Clinical Practice. World Book Company. Chicago, 1927, Pp x + 315.

Wells, F. L. and Kelley, C. M. "Intelligence and Psychosis." American Journal of Insanity, 1920, Vol. lxxvii: 17-45.

Wells, F. L. and Kelley, C. M. "The Simple Reaction in Psychosis." American Journal of Psychiatry, 1922, Vol. ii: 53-59.

Wells, F. L. and Martin, H. A. A. "A Method of Memory Examination Suitable for Psychiatric Cases." American Journal of Psychiatry, 1923, Vol. iii: 243-257.

Wentworth, Mary M. "Two Hundred Cases of Dementia Praecox, Tested by the Stanford Revision." *Journal of Abnormal Psychology*, 1923, Vol. xviii: 378-388.

Winkelman, N. "Metrazol Treatment in Schizophrenia." *American Journal of Psychiatry*, 1938, Vol. xcv: 303 ff.

Wittman, Phyllis. "The Babcock Deterioration Test in State Hospital Practice." *Journal of Abnormal and Social Psychology*, 1933-4, Vol. xxvii: 70-84.

Woodrow, H. "Mental Unevenness and Brightness." *Journal of Educational Psychology*, 1928, Vol. xix: 298-302.

Woodworth, R. S. "Computing the Standard Deviation and Probable Error of a Binet Mental Age." *Psychological Bulletin*, 1928, Vol. xxv: 167.

Wooster-Drought, C. "Hystero-Epilepsy." *British Journal of Psychology, Medical Section*, 1934, Vol. xiv: 50-82.

Yerkes, R. M., Bridges, J. W. and Hardwick, R. S. *A Point Scale for Measuring Mental Ability*. 2nd edition, 1923. Baltimore, Warwick and York, Inc. Pp 219.

AUTOBIOGRAPHY.

ANNA LOUISE SYMONDS
      Born December 2, 1871, Lynn, Mass.

PARENTS - WALTER E. SYMONDS
              ANNIE M. WARREN

SCHOOL HISTORY -
    Lynn public schools.
      Graduated from High School, June, 1887.
      Post-graduate year at High School.
    Boston University, C.L.A.
      Entered September, 1888.
      A.B. degree, June, 1892.

PROFESSIONAL POSITIONS -
    None held. Much substitute teaching for seven years in local
    high schools.

MARRIED -
    CHARLES A. COLLINS
      October 5, 1899.

CHILDREN -
    Three.

RECENT COLLEGIATE HISTORY.
    Boston University, Graduate School
      Enrolled September, 1933.
      A.M. degree, June, 1935.
      Re-enrolled, September, 1935.
    Radcliffe Graduate School
      Enrolled September, 1935.

RESEARCH WORK -
    Volunteer at the Boston Psychopathic Hospital since June, 1937.

AMERICAN PSYCHOLOGICAL ASSOCIATION
    Associate member, September, 1938.